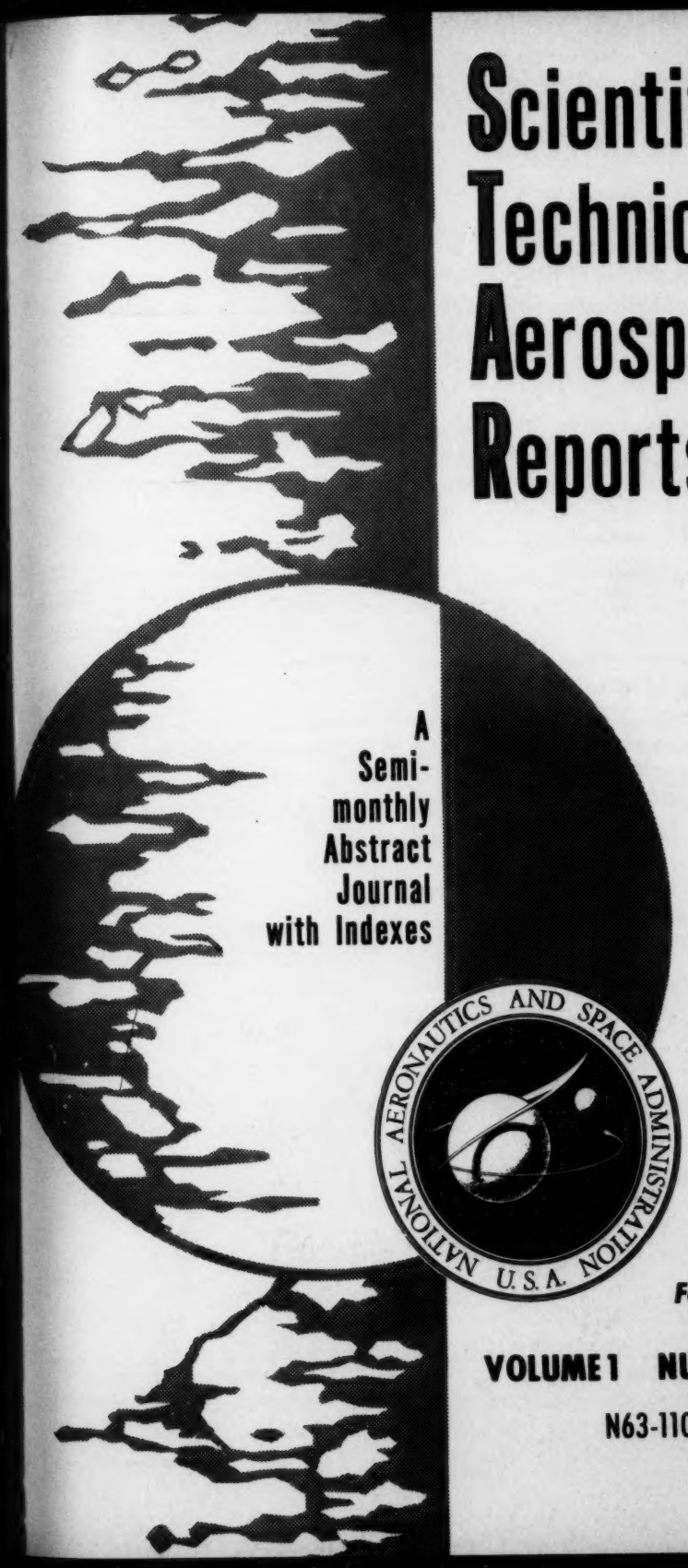

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A Semi-monthly Abstract Journal with Indexes

February 8, 1963

VOLUME 1 NUMBER 3

N63-11000—N63-11544

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APR 8 1963

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United States Government

National Aeronautics and Space Administration

Office of Scientific and Technical Information

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, December 20, 1962

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VOLUME 1 NUMBER 3

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A Semimonthly Publication of the National Aeronautics and Space Administration

February 8, 1963

01 GENERAL

Includes: management; space law and legal matters; symposia or conferences of a broad or a general nature.

N63-11013 Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 29, 1962

K. V. Kuvshinova et al Feb. 15, 1962 42 p 65 refs Contains abstracts, summaries, and translations of articles from recent publications of the Sino-Soviet Bloc countries

(JPRS-12445) OTS: Annual subscription, $16.00

This report, containing abstracts, summaries, and translations, covers the following: astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space research. J.R.C.

N63-11058 Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio

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N63-11129 Congress. House. Committee on Science and Astronautics

REPORT ON THE ACTIVITIES OF THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, U.S. HOUSE OF REPRESENTATIVES, EIGHTY-SEVENTH CONGRESS, SECOND SESSION Serial W
Washington, GPO, 1962 17 p

This report lists and summarizes the activities of the Committee on Science and Astronautics. The report lists the investigations, hearings, and legislations carried out. New modes of land, air, and sea transportation being investigated include the ground effect machine (GEM), hydrofoils, monorails, submersibles, and new types of aircraft, such as vertical takeoff planes. J.R.C.

N63-11130 Congress. Senate. Committee on Aeronautical and Space Sciences

NATIONAL AERONAUTICS AND SPACE ACT OF 1958, AS AMENDED THROUGH THE END OF THE 87TH CONGRESS, OCTOBER 13, 1962 Staff Report Prepared for the Committee on Aeronautical and Space Sciences, United States Senate
Washington, GPO, Nov. 20, 1962 37 p

The National Aeronautics and Space Act, as amended, includes the following: declaration of policy and purpose, coordination of aeronautical and space activities, and the establishment of National Aeronautics and Space Administration and other aeronautical and space organizations. It is determined that the exploration of space will be under the control of a civilian agency, NASA. J.R.C.

N63-11137 National Aeronautics and Space Administration, Washington, D.C.

PROCEEDINGS OF THE SECOND NATIONAL CONFERENCE ON THE PEACEFUL USES OF SPACE, SEATTLE, May 8-10, 1962
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N63-11152 Federal Communications Commission, Washington, D.C.

REGULATORY ASPECTS OF SATELLITE COMMUNICATIONS SYSTEMS
Max D. Paglin *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 193-196 (See N63-11137 03-01)

This paper discusses the regulatory aspects of satellite communications systems. The "Communications Satellite Act of 1962" was passed by the House of Representatives, and similar action is expected by the Senate. Briefly, the legislation under consideration provides for the formation of a private corporation, the ownership of which is to be divided equally between authorized carriers and the public-at-large. It sets forth in detail the responsibilities of the President, the NASA, and the FCC in relation to the proposed corporation and the communications satellite program as a whole. J.R.C.

N63-11153 Department of State, Washington, D.C.
SOME FOREIGN POLICY IMPLICATIONS OF SPACE SCIENCE
Howard Furnas *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 197-199 (See N63-11137 03-01)

This paper presents some foreign policy implications of space science. Although the practical applications of space science still await further development and experimentation for their complete realization, the present research and international cooperative space programs of the United States are already playing a substantial role in our foreign relations. It is our desire and expectation that this role will increase in importance. J.R.C.

N63-11154 RAND Corp., Santa Monica, Calif.
THE ECONOMIC IMPORTANCE OF SPACE TECHNOLOGY
William H. Meckling *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 201-203 (See N63-11137 03-01)

The possibilities of realizing economic gains from the space program are discussed. The applications of space technology that are closest to realization today are communication satellites and meteorological satellites. Realistic evaluations of the economic implications of these applications will be possible only after further experimentation. The most promising economic gains will probably be made from unforeseen innovations and increased scientific knowledge. R.C.M.

N63-11213 Congress. House. Committee on Government Operations
SYSTEMS DEVELOPMENT AND MANAGEMENT (PART I) Hearings before a Subcommittee of the Committee on Government Operations, U. S. House of Representatives, June 21, 22, 27, 29, and Aug. 15, 1962 For Part 2, see N63-11214 03-01; Part 3, see N63-11215 03-01; Part 4, see N63-11216 03-01
Washington, GPO, 1962 437 p
(87th Cong. 2nd Sess. Committee Print)

The text of the hearings before the Military Operations Subcommittee of the U. S. House of Representatives is presented in five volumes. The basis for the hearings was the report to the President on "Government Contracting for Research and Development," known as the Bell report. This report presents the policy guidelines for (1) deciding how vital research and development programs will be apportioned between Government and non-Government operations; (2) improving the Government's ability to review contractor operations and perform scientific and technical work; and (3) obtaining better contractor performance and lower costs. Witnesses representing Government Agencies, the Military Departments, the nonprofit corporations, assisting the Department of Defense with specialized technical services, and the industrial organizations were heard in an effort to clarify the major issues presented in the Bell report. M.P.G.

N63-11214 Congress. House. Committee on Government Operations
SYSTEMS DEVELOPMENT AND MANAGEMENT (PART II) Hearings before a Subcommittee of the Committee on Government Operations, U. S. House of Representatives, July 23, 24, 25, 26, and 27, 1962 For abstract see N63-11213 03-01
Washington, GPO, 1962 378 p
(87th Cong. 2nd Sess. Committee Print)

N63-11215 Congress. House. Committee on Government Operations
SYSTEMS DEVELOPMENT AND MANAGEMENT (PART III) Hearings before a Subcommittee of the Committee on Government Operations, U. S. House of Representatives, August 1, 2, 3, 6, 7, 9, 10, and 13, 1962 For abstract see N63-11213 03-01
Washington, GPO, 1962 570 p
(87th Cong. 2nd Sess. Committee Print)

N63-11216 Congress. House. Committee on Government Operations
SYSTEMS DEVELOPMENT AND MANAGEMENT (PART IV) Hearings before a Subcommittee of the Committee on Government Operations, U. S. House of Representatives, August 13, 14, 15, 16, 20, and 21, 1962 For abstract see N63-11213 03-01
Washington, GPO, 1962 280 p
(87th Cong. 2nd Sess. Committee Print)

N63-11217 Congress. House. Committee on Government Operations
SYSTEMS DEVELOPMENT AND MANAGEMENT (PART V) Hearings before a Subcommittee of the Committee on Government Operations, U. S. House of Representatives, August 28, 29, 30, and 31, 1962 For abstract see N63-11213 03-01
Washington, GPO, 1962 360 p
(87th Cong. 2nd Sess. Committee Print)

N63-11223 Air Force Cambridge Research Labs., Bedford, Mass.
HISTORY AND PROGRESS OF AFCRL [First Annual Report, January 1961-June 1962]
Carl Berger and La Verne E. Woods Oct. 1962 217 p 731 refs
(AFCRL-62-714)

This volume constitutes the first annual unclassified report of the Air Force Cambridge Research Laboratories. It replaces narratives previously published separately by the organization's Electronics and Geophysics Research Directorates. Although it is considered the fiscal year 1962 report, it has been expanded to cover the 18-month period from 1 January 1961. Its purpose is to provide military and civilian agencies unclassified information on the scope and progress of the Laboratories' in-house research programs. Author

N63-11239 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
A REVIEW OF THE AIR FORCE MATERIALS RESEARCH AND DEVELOPMENT PROGRAM [Final Report, July 1, 1961-June 30, 1962]
Donna J. Tate Nov. 1962 256 p 442 refs
(WADC-TR-53-373, Suppl. 9)

These reports cover basic and applied research being conducted in the materials area by the Metals and Ceramics, Non-Metallic Materials, Physics, Manufacturing Technology, and Applications Laboratories of the Directorate of Materials and Processes. Author

N63-11348 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY MONTHLY PROGRESS REPORT FOR APRIL 1962
J. F. Eichelberger Nov. 9, 1962 24 p
(Contract AT(33-1)-GEN-53)
(MLM-1136)

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N63-11349 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY MONTHLY PROGRESS REPORT FOR MAY 1962
G. R. Grove, L. V. Jones, and J. F. Eichelberger Nov. 30, 1962 36 p
(Contract AT(33-1)-GEN-53)
(MLM-1137)

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N63-11350 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY PROGRESS REPORT FOR JUNE 1962
G. R. Grove, L. V. Jones, and J. F. Eichelberger Dec. 5, 1962 22 p
(Contract AT(33-1)-GEN-53)
(MLM-1138)

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N63-11537 Bollay (E.) Associates, Inc., Santa Barbara, Calif.
DIGEST OF ECONOMIC IMPACT OF WEATHER INFORMATION ON AVIATION OPERATIONS Memorandum Report
Washington, Federal Aviation Agency. Systems Research and Development Service, Dec. 1962 43 p
(Contract FAA/BRD-410)

This report is a digest of the material contained in the publication entitled *Economic Impact of Weather Information on Aviation Operations*. It includes estimates of the economic penalties to aviation caused by the lack of, or inadequate, weather information; the cost of implementing an improved weather system; the economic benefits that such a system would bring; and, finally, the expected benefit-to-cost ratio. Author

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes: aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc.

For related information see: 03 Aerodynamics of Wings, Rotors and Control Surfaces; and 11 Fluid Mechanics.

N63-11006 General Electric Co. Missile and Space Vehicle Dept., Philadelphia, Pa.
A METHOD FOR THE PREDICTION OF THE PRESSURE DISTRIBUTION ON THE CONICAL PORTION OF A SPHERE-CONE Aerodynamics Fundamentals Memo 131 (Nov. 1961), and Addendum (Mar. 1962)
E. M. Storer 1962 19 p 9 refs In 2 vols.

A method of predicting a pressure distribution on the conical portion of a sphere cone with reasonable accuracy for Mach numbers of 10 or greater is described. The method is a modification of the Vaglio-Lauren-Trella method which correlates flow-field calculations when the configuration and one flight condition (one Mach number and altitude) are given. With the modified method, the axial distance from the sphere-cone junction is stretched by a factor proportional to the average of the density ratios at the body stagnation point and immediately behind the normal shock. Four different sphere-cone configurations were investigated; 9°, 12.5°, 15.567° and 24°. The calculations were performed for several flight conditions for each configuration, and a median curve was drawn through all the plots for each shape; the procedure was then reversed, and the median curve was used to calculate the body pressures for several conditions. Good agreement was obtained in both cases. Attempts to interpolate the median curves for a cone angle not included in the initial data also showed good agreement; however, since the median curves were constructed using flow-field solutions of Mach number ≥ 10, this method should be used only at hypersonic Mach numbers. M.P.G.

N63-11049 Brown U. Div. of Engineering, Providence, R.I.

UNIFORMLY VALID SECOND-ORDER SOLUTION FOR SUPERSONIC FLOW OVER CRUCIFORM SURFACES

James Wallace, Jr., and Joseph H. Clarke June 1962 29 p 6 refs (Contract NOw-62-0604-c)
(CM-1019)

The second-order supersonic flow over a cruciform configuration, consisting of two intersecting rectangular wings of high aspect ratio, is considered. The practical interest is in application to supersonic inlets, wing-body junctions and vehicle fins. The fundamental interest centers about identification and adjustment of the severe local failures of the ordinary second-order theory. For wings with discontinuous slopes, discontinuous potentials occur across the planar shock, and square-root singularities in the velocities occur at the intersection of these shocks with the cruciform surfaces. A second-order solution uniformly valid to first order is constructed by adjustment of the ordinary second-order solution obtained first. The uniformly valid solution has two different series representations in the thickness parameter. One is the ordinary second-order series in ascending integral powers of the thickness parameter which is valid in the interior of the vertex-centered undisturbed Mach cone, and the other is a series containing fractional powers which is valid adjacent to and upstream of this Mach cone. The uniformly valid solution gives the detailed wave structure and shows a flow regime upstream of the vertex-centered undisturbed Mach cone not predicted by the ordinary theory. The two solutions are otherwise identical. The wave structure consists of a pyramidal arrangement of planar shocks adjacent to and upstream of the above cone, followed by weaker oblique expansion fans and finally by two extremely weak shocks coincident with the vertex-centered undisturbed Mach cone. Author

N63-11063 Massachusetts Inst. of Tech., Cambridge

THEORETICAL HYPERVELOCITY UNSTEADY AERODYNAMICS

Holt Ashley and Garabed Zartarian *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 163-218 46 refs (See N63-11058 03-01)

Principal design information required of unsteady aerodynamic theory at hypersonic speeds is reviewed in the light of probable configurations and the nature of their time-dependent motions. Emphasis is placed on quasi-steadiness and on the reduction to equivalent steady flows. Concentrating on the airloads problem, approximate methods for preliminary estimation are discussed relative to pointed and blunted shapes over various ranges of the hypersonic parameter. There follow comments about more exact theories, research needed to assure their usefulness, and the role of the high-speed computer. The influences of viscosity and finite reaction rates must often be considered, and their relationship to unsteady phenomena is described. Author

N63-11067 Massachusetts Inst. of Tech. Aerophysics Lab., Cambridge

THE AERODYNAMICS OF DISTORTED SURFACES

Eugene E. Covert *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 369-406 11 refs (See N63-11058 03-01)

The problem of computing the pressures on an aerodynamic surface subject to a smooth distortion is discussed in terms of linear and second-order theories and an empirical approach. It is shown that the linear theory is valid only for very slight distortions. The empirical procedure is generally accurate to within 5 percent although it is hard to determine the limits of application. The second-order procedures are generally more accurate and appear valid over a wide range of Mach numbers. Author

N63-11132 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FREE-FLIGHT MEASUREMENTS OF DRAG AND STATIC STABILITY FOR A BLUNT-NOSED 10° HALF-ANGLE CONE AT MACH NUMBER 15

Dale L. Compton Washington, NASA, Apr. 1961 18 p 6 refs (NASA-TM-X-507) OTS: $1.60 ph, $0.80 mf

Measurements were made in a supersonic free-flight wind tunnel at a nominal Mach number of 15 and nominal Reynolds number of 2.8×10^6. The experimental static stability data were found to fit a cubic pitching-moment curve. Author

N63-11237 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

AERODYNAMIC STABILITY OF PLANETARY ENTRY-VEHICLES

W. Brofman Sept. 24, 1962 19 p 6 refs
(Contract NAS7-100)
(JPRL-TR-32-338) OTS: $1.60 ph, $0.80 mf

Allen's solution for the envelope of oscillation of a planetary-entry vehicle is presented in a single figure which permits rapid estimation of the angle of attack at critical points of the trajectory for all planets and vehicles. An analog investigation of a family of bodies with nonlinear aerodynamic moment coefficients entering the Martian atmosphere at large angles of attack revealed that, with a correction factor, Allen's results for the linear case can be used. This correction factor was found to depend only on the initial angle of attack (i.e., was independent of vehicle, trajectory, and atmospheric characteristics). Small to moderate initial tumbling rates had no effect on the maximum amplitude of oscillation of bodies entering at arbitrary angles. Author

N63-11419 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

NONEQUILIBRIUM SCALING CRITERION FOR INVISCID HYPERSONIC AIRFLOWS

W. E. Gibson and P. B. Marrone Nov. 1962 49 p 17 refs
(Contract DA-30-069-ORD-3443; ARPA Order 253-62; Proj. Defender)
(CAL-QM-1626-A-8)

A study is presented of binary scaling for nonequilibrium airflows about blunt bodies. The coupled chemistry of air is considered for flight speeds of 15 and 23 kft/sec. For a fixed flight speed and a given body shape, the nonequilibrium flow field can be scaled when the product of body radius and free-stream density is kept fixed. This similitude applies when three-body recombinations are negligible. Author

N63-11425 Aro, Inc., Arnold Air Force Station, Tenn.

FORCE MEASUREMENTS ON A DATA CAPSULE IN THE WAKE AND FLOW FIELD OF A CARRIER VEHICLE AT MACH 8

L. D. Kayser and G. H. Merz Arnold Engineering Development Center, Dec. 1962 24 p 4 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-220)

Force measurements were obtained on a data capsule in the flow field and wake of a carrier vehicle. Data were obtained during the following three basic phases of testing: (1) a survey of the flow field, (2) penetration of the wake boundary, and (3) survey of the wake core. In addition, data were obtained with the capsule in the tunnel free stream. The tests were conducted at a Mach number of 8.09 and a free-stream Reynolds number of 3.4×10^6 per foot. Selected results from this investigation are presented. Author

N63-11427 David Taylor Model Basin. Aerodynamics Lab., Washington, D.C.

WIND-TUNNEL INVESTIGATION OF JET BLOWING OVER A WINGLESS MISSILE BODY AT MACH NUMBERS OF 2.16, 2.48, AND 2.85

C. Carl Brindle Sept. 1962 55 p 4 refs
(DTMB-AERO-1040)

This report presents the results of a wind-tunnel investigation to ascertain the feasibility of using asymmetric jet blowing of air over a portion of a wingless missile body to produce lift and control. Adequate lift-and-control forces at low angles of attack can be produced by blowing. For the use contemplated, however, the associated drag penalty would considerably reduce the flight range of the missile configurations tested. Author

N63-11462 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INFLUENCE OF DRAG DURING BOOST ON ROCKET VEHICLE PERFORMANCE

Alan D. Levin Repr. from ARS Journal, Oct. 1962 p 1620-1621 2 refs Previously issued as a preprint; for abstract see N62-13827 11-02

The influence of drag during boost on rocket vehicles was investigated. Results are presented for $(\text{thrust-to-weight ratio})_1 = 1.50$, $(\text{thrust-to-weight ratio})_2 = 0.75$, and for stage structure-to-gross-weight ratio = 0.05 and 0.10. The complete investigation covered the range of $(\text{thrust-to-weight ratio})_1$ from 1.25 to 2.00 and $(\text{thrust-to-weight ratio})_2$ from 0.75 to 2.00. Under the conditions of the ascent trajectory assumed for orbit altitudes up to about 400 nautical miles, the effect of drag during boost resulted in a reduction of about 0.002 in payload-to-gross-weight ratio. For a constant drag coefficient value of 0.4 equal to the average value of drag coefficient vs Mach number, the effect on payload-to-gross-weight ratio was less than the actual drag variation. However, the most significant drag effect is on the burnout characteristics, and to obtain a reasonable approximation to the flight characteristics a relatively large constant value for the drag coefficient compared to the average value should be used in any analysis. I.v.L.

N63-11513 National Aeronautics and Space Administration, Washington, D.C.

AERODYNAMICS OF SPACE VEHICLES

Robert W. Boswinkle, Jr., John P. Campbell, Mitchel H. Bertram, David E. Fetterman, Jr., John R. Henry, R. L. Trimpi, F. C. Grant, and Nathaniel B. Cohen 1962 57 p 120 refs Papers presented at Session Q of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)

(NASA-SP-23) GPO:

CONTENTS:

1. AERODYNAMIC PROBLEMS OF LAUNCH VEHICLES R. W. Boswinkle, Jr. (NASA. Langley Research Center) 9 p 15 refs
2. LOW-SPEED AERODYNAMIC RESEARCH RELATED TO THE LANDING OF SPACE VEHICLES J. P. Campbell (NASA. Langley Research Center) 12 p 9 refs
3. THE AERODYNAMICS OF HYPERSONIC CRUISING AND BOOST VEHICLES M. H. Bertram, David E. Fetterman, Jr., and John R. Henry (NASA. Langley Research Center) 20 p 54 refs
4. AERODYNAMIC AND HEATING PROBLEMS OF ADVANCED REENTRY VEHICLES R. I. Trimpi, F. C. Grant, and N. B. Cohen (NASA. Langley Research Center) 15 p 42 refs

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes: ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N63-11210 Oak Ridge National Lab., Tenn.

AN AERODYNAMIC-THERMODYNAMIC STUDY OF CENTRIFUGAL COMPRESSORS

G. T. Colwell (M.S. Thesis—Tennessee U.) Dec. 18, 1962 85 p 38 refs

(Contract W-7405-eng-26)

(ORNL-3294) OTS: $2.00

A procedure is presented for the aerodynamic and thermodynamic design of centrifugal compressors. Design equations are derived from basic laws of thermodynamics and fluid flow where possible. The available information has been supplemented with mathematical developments and explanations. Of particular interest is the derivation of equations which provide for estimating the velocity distribution on the leading edge of an impeller vane. Also included is an example of an aerodynamic-thermodynamic design of an impeller and a volute-conical diffuser combination. All the necessary steps are demonstrated, beginning with a set of basic compressor requirements and resulting in a layout of the impeller and casing. Author

N63-11285 College of Aeronautics, Cranfield (Gt. Brit.)

EXPERIMENTS ON A 70° CROPPED DELTA WING WITH 90° DOWNWARD DEFLECTED PERIPHERAL BLOWING

A. J. Alexander (Ph. D. Thesis—London U.) Sept. 1962 29 p 8 refs

(COA-N-131)

Low-speed wind-tunnel tests have been made to find the effects of using downward deflected peripheral blowing to improve landing and takeoff performance. Peripheral blowing was incorporated on a 70° cropped delta wing, and lift, drag, and pitching moment were measured both without a ground and with a ground board at height/chord ratios of 0.025, 0.075, 0.15. Wind speed was varied between 0 and 100 ft/sec. and C_μ values of 0 to 7.5 were obtained, sufficient to cover adequately the flight regime from hovering to cruise. Incidence was varied between −3° and +20° except for small height/chord ratios where the incidence range was limited by the ground board. Calculations of takeoff and landing performance, using this experimental data, of a large supersonic airliner show that takeoff distance to 50 feet and landing distance over a 50-foot screen are of the order of 4,000 feet or approximately one-half of the distances required by a conventional aircraft. A further advantage with this scheme is that unprepared grass strips would be suitable as runways, thus greatly increasing the flexibility of large aircraft. Author

N63-11314 Grumman Aircraft Engineering Corp., Bethpage, N.Y.

MATCHING CONDITIONS FOR THE MODIFIED NEWTONIAN, PRANDTL-MEYER EXPANSION, PRESSURE ESTIMATION TECHNIQUE FOR HYPERSONIC FLOWS OVER BLUNT BODIES

Louis G. Kaufman II July 1962 71 p 9 refs

(RM-205)

Pressure distributions on blunt bodies in hypersonic flows can be estimated by applying a combination of the modified Newtonian and Prandtl-Meyer expansion methods. The two methods are matched at the point where the pressure gradients calculated using each method are equal. Existence and uniqueness conditions for the matching point require high supersonic ($M_1 \gtrsim 3$) free streams. Tables and charts for the method are given and example calculations, including real gas effects, are compared with those of other pressure estimation procedures. Author

04 AIRCRAFT

Includes: specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; stability and control.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N63-11123 National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

OPERATIONAL EXPERIENCES AND CHARACTERISTICS OF THE X-15 FLIGHT CONTROL SYSTEM

Robert A. Tremant Washington, NASA, Dec. 1962 50 p 4 refs (NASA TN D-1402) OTS: $1.25

X-15 flight and simulator experiences with the manual flight control and stability augmentation system for the period from December 1958 to January 1962 are presented. The flight data extend to a Mach number of 6.04 and an altitude of 217,000 feet, and the simulator data cover the design flight envelope. The characteristics of the manual flight control system and the stability augmentation system are discussed, in conjunction with pilot evaluation, operational problems, modifications, and reliability. Pertinent X-15 flight history is included. Author

N63-11155 Aerospace Medical Center. School of Aerospace Medicine, Brooks AFB, Tex.

MANHIGH BALLOON FLIGHTS IN PERSPECTIVE

David G. Simons *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 243-248 (See N63-11137 03-01)

The balloon flights carried out under the Manhigh Project are reviewed. These flights were made to check the life support systems and to determine man's ability to perform tasks in the space environment. The physiological data collected in these flights are shown to present a new challenge to the problem of manned spaceflight. The degree of mental alertness and creativity of crew members can be understood only by relating the performance of the mind with the function of the body. R.C.M.

N63-11157 General Motors Corp. Defense Research Labs., Santa Barbara, Calif.

A CONSIDERATION OF THE U.S. NAVY STRATO-LAB BALLOON PROGRAM AND ITS CONTRIBUTIONS TO MANNED SPACE FLIGHT

Malcolm D. Ross *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 257-261 (See N63-11137 03-01)

The Strato-Lab balloon program and its contributions to manned spaceflight are discussed. The Strato-Lab allows an opportunity for man to conduct tests and evaluate specific components and/or techniques in an extremely high-altitude environment. A study is made of man's reactions to an actual environment of physiological and psychological stress. J.R.C.

N63-11158 National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

THE X-15 FLIGHT PROGRAM

Neil A. Armstrong, Joseph A. Walker, Forrest S. Petersen (NAS, Miramar, Calif.) and Robert M. White (AF Flight Test Center, Edwards AFB, Calif.) *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 263-271 (See N63-11137 03-01)

This paper reviews the philosophy of the X-15 airplane, describes its concept in operation, and prophesies its future. The X-15 was the first design to require rocket reaction control within its design envelope. The flight and landing of the X-15 are reviewed. Some of the follow-on uses for the X-15 include guidance-instrument experiments, precise determination of atmospheric density at extreme altitude, measurement of quantity and size of micrometeorites in near space, and determination of the intensity of ultraviolet and infrared rays in near space. J.R.C.

N63-11284 College of Aeronautics, Cranfield (Gt. Brit.)

TRENDS IN AIRCRAFT DESIGN

A. F. Newell and D. Howe May 1962 25 p 14 refs Paper presented to the Eighth Production Engrs. Conf., Apr. 5-7, 1962 (COA-N-127)

The improved performance of aircraft during the past decade has resulted in the need for new design and production techniques. Particular examples are integral construction and the use of sandwich panels. Although these processes are costly, especially when applied to titanium and steel construction, their use is likely to be necessary, at least to some extent, on many supersonic aircraft. The supersonic airliner is no exception to this, and the paper discusses the design aspects of this type of aircraft which have a bearing on production problems. It is concluded that more research aimed at reducing the cost of sophisticated forms of construction is required. Author

N63-11286 College of Aeronautics, Cranfield (Gt. Brit.)

SOME TESTS ON A CIRCULAR GROUND EFFECT MACHINE WITH FORWARD SPEED

T. M. Harris, J. H. Davies, and A. J. Alexander Oct. 1962 16 p 1 ref

(COA-N-133)

Wind tunnel tests have been made on a circular wing with 90° downward peripheral blowing both in and out of ground effect. Tests made with two slot widths, a range of blowing pressures and choked jets, indicate that C_μ is a unifying parameter for this type of test. The windspeed was varied between 0 to 200 ft/sec. at zero incidence and the static pressure distribution on both top and bottom surfaces was measured. The sum of the integrated pressures on both upper and lower surfaces agreed reasonably well with the measured overall lift. Flow visualization on a streamwise plate beneath the model showed the vortex system and the eventual collapse of the forward jet with increasing windspeed. Author

N63-11445 Princeton U., N.J.

A NOTE ON THE EFFECT OF HELICOPTER DYNAMICS ON STEEP INSTRUMENT APPROACHES

Edward Seckel, J. J. Traybar, and G. E. Miller Feb. 1962 34 p 10 refs

(Contract DA 44-117-TC-524)

(Aeronautical Eng. Rept. 600)

A series of flight tests with a number of qualified pilots and a variable stability aircraft were conducted to determine the influence on pilot opinion of certain stability parameters in steep instrument approaches in turbulence with a helicopter. The parameters varied were: velocity stability, angle-of-attack stability, and angular damping. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes: celestial mechanics; and radioastronomy.

For related information see: 12 Geophysics; and 29 Space Sciences.

N63-11196 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.

RADIO MEASUREMENTS OF TWO TOTAL ECLIPSES Research Report

John P. Castelli, Helen W. Cohen, Ronald M. Straka, and Jules Aarons Aug. 1962 42 p 7 refs
(AFCRL-62-852)

Multifrequency records of two total eclipses of the sun—2 Oct 1959 and 15 Feb 1961— have been analyzed. The position of the moon's limb during increases and decreases of the slopes of the eclipse curve has been compared with optical maps and radio heliograms in an attempt to study the bright radio regions on the sun. Angular diameters of a few enhanced regions were found to vary between 0.75 and 1.25 min of arc. Brightness temperature of one region was 1.5×10^5 °K at 9700mc and 9×10^5 °K at 1270mc. Heights of emitting regions at various frequencies were calculated in two cases. No conclusions as to limb brightening could be made because of the presence of enhanced radio regions near both limbs during both eclipses. Residual energy at totality on 2 Oct was approximately 20% at both 1300 and 3000 mc; on 15 Feb it was 9.6% at 9700 mc and 25.3% at 1270 mc. Author

N63-11205 Joint Publications Research Service, Washington, D.C.

STUDIES IN USSR RADIOASTRONOMY

V. V. Vitkevich, P. D. Kalachev, and A. Ye. Salomonovich Dec. 20, 1962 52 p 7 refs Transl. of two articles from Tr. Fiz. Inst., Akad. Nauk SSSR, Radioastron. (Moscow), v. 17, 1962 p 3-41
(JPRS-16786) OTS: $5.60

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1. DEVELOPMENT OF RADIOASTRONOMY RESEARCH IN THE RADIOASTRONOMY LABORATORY OF THE PHYSICS INSTITUTE, ACADEMY OF SCIENCES USSR V. V. Vitkevich p 1-12
2. RADIOTELESCOPE WITH 22-METER REFLECTOR P. D. Kalachev and A. Ye. Salomonovich p 13-49 7 refs

N63-11250 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

PLANETARY POSITION-VELOCITY EPHEMERIDES OBTAINED BY SPECIAL PERTURBATIONS

P. R. Peabody and Neil Block N. Y., Am. Rocket Soc. [1962] 8 p 11 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2602-62) ARS: $0.50 members, $1.00 nonmembers

Position-velocity ephemerides of Venus and the Earth-Moon system have been generated using special perturbation methods, in which conditions at initial epoch are determined so that the subsequent positions are in best agreement with the Newcomb ephemerides in the least-squares sense. The ephemerides so obtained made possible the 1961 Jet Propulsion Laboratory (JPL) radar observations of Venus, and were used in the subsequent determination of the published JPL value of the Astronomical Unit. They are also being used in generating acquisition ephemerides for future radar observations of Venus and in calculating preflight Mariner standard trajectories. Comparison of the residuals between the Newcomb and the new ephemerides discloses clearly the major discrepancies in the Newcomb theory. The success of the method has led to the current development of an ephemeris library system which will be used to develop internally consistent position-velocity ephemerides of all the planets and the Moon, and which will be of greatest possible accuracy over long arcs. Author

N63-11251 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PERIODIC ORBITS FOR MOON PROBES

Su-Shu Huang N.Y., Am. Rocket Soc. [1962] 4 p 4 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper 2603-62) ARS: $0.50 members, $1.00 nonmembers

A general discussion is presented on the broadening of scope, purpose, and, consequently, technique of celestial mechanics as a result of the coming of the space age. The discussion is focused on the time-scale of the objects of interest under study. The name "Space Mechanics" is suggested, in order to distinguish the more rigorous part of classical celestial mechanics, to cover the ground of study which is empirical in purpose and numerical in approach. Within the framework of the restricted three-body problem, some periodic orbits, which enclose both the two finite bodies, have been searched. This represents only the first step in looking for some orbits which will permit a moon-probing vehicle to make periodic encounters with the moon at its other side. Two families of periodic orbits have been found—one stable, one unstable—in the orbital plane of the hypothetical moon. Such periodic orbits outside the orbital plane have also been searched. Although a periodic orbit has been numerically obtained, it does not enclose the moon. Author

N63-11279 Centro di Studio per la Fisica delle Microonde, Florence (Italy)

METEOR DATA BULLETIN No. 8, JUNE 1961

Nello Carrara et al Sept. 1962 16 p
(Partially sponsored by USAF)

Meteor radar data obtained at the Centro Microondo in June 1961 were analyzed to give the hourly rate as a function of the time, antenna direction, and radar distance. This distribution of the echo duration and the duty cycle were computed. More detailed observations on drifting echoes and particular echoes observed are reported. Author

N63-11280 Centro di Studio per la Fisica delle Microonde, Florence (Italy)

METEOR DATA BULLETIN NO. 9, JULY 1961

Nello Carrara et al Oct. 1962 16 p
(Partially sponsored by USAF)

Meteor radar data obtained at the Centro Microondo in July 1961 were analyzed to give the hourly rate as a function of the time, antenna direction, and radar distance. The distribution of the echo duration and the duty cycle were computed. More detailed observations on drifting echoes and particular echoes observed are reported. Author

N63-11322 RAND Corp., Santa Monica, Calif.

THE STUDY OF PLANETARY ATMOSPHERES BY STELLAR OCCULTATION

H. L. Weisberg Oct. 1962 47 p 11 refs
(NASA Contract NAS7-100; JPL Contract N-33561)
(RM-3279-JPL) OTS: $4.60 ph, $1.61 mf

The vertical structure of a planetary atmosphere can be studied by observing the intensity of light from a star as it passes behind the atmosphere at the limb of the planet. The theory for interpreting such observations is reviewed. With balloon astronomy, this technique may be very useful. A possible study of the Martian atmosphere by observing eclipses of Phobos is also discussed. Finally, use of this technique with a flyby space probe, where it would complement other measurements, is proposed and analyzed. Author

N63-11428 RAND Corp., Santa Monica, Calif.

DERIVATION OF THE FORMULAE FOR THE REDUCTION OF PLANETOGRAPHIC OBSERVATIONS WITH SPECIAL REFERENCE TO THE PLANET MARS

K. Graff June 1962 38 p Transl. from the German by C. H. Michelis
(NASA Contract NASr-21 (04))
(RM-3138-NASA) OTS: $3.60 ph, $1.34 mf

A translation is presented of an article giving an extensive treatment of the basic astronomical formulas and equations appropriate

to the study of the planet Mars. This translation was prepared as part of a study of solar-system constants and parameters being conducted for the National Aeronautics and Space Administration.

Author

N63-11505 National Aeronautics and Space Administration, Washington, D. C.

CELESTIAL MECHANICS AND SPACE FLIGHT ANALYSIS

Clarence R. Gates, Paul R. Peabody, William M. Kaula, Thomas W. Hamilton, and William G. Melbourne 1962 42 p 65 refs Papers presented at Session I of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29)

(NASA-SP-15) GPO:

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1. INTRODUCTION. CELESTIAL MECHANICS: HISTORICAL BACKGROUND C. R. Gates (JPL) 2 p
2. APPLICATIONS OF NUMERICAL ANALYSIS AND COMPUTER TECHNIQUES IN CELESTIAL MECHANICS P. R. Peabody (JPL) 6 p
3. ANALYSIS OF SATELLITE ORBITS FOR GEOPHYSICAL EFFECTS W. M. Kaula (NASA. Goddard Space Flight Center) 11 p 39 refs
4. APPLICATIONS OF CELESTIAL MECHANICS TO SPACECRAFT FLIGHT T. W. Hamilton (JPL) 8 p 3 refs
5. SPACE FLIGHT OPTIMIZATION W. G. Melbourne (JPL) 13 p 23 refs

N63-11523 Joint Publications Research Service, Washington, D.C.

NEWS OF HIGHER EDUCATIONAL INSTITUTIONS, MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION USSR, RADIOPHYSICS SERIES

Oct. 1, 1962 528 p 179 refs Transl. of 29 articles from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 211-415

(JPRS-15517; OTS-62-11782) OTS: $6.00

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2. ELECTRON DISTRIBUTION OVER THE RADIUS OF A METEOR TRAIL V. V. Sidorov and R. Yu. Fakhrutdinov p 12-22 5 refs (See N63-11525 03-05)
3. DISTORTION OF MODULATION OF POWERFUL RADIO WAVES PROPAGATING IN THE IONOSPHERE (EXPERIMENTAL INVESTIGATION), II I. M. Vilenskiy p 23-51 8 refs
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7. FLUCTUATIONS OF RADIO WAVES IN THE NEAR ZONE ABOVE A PLANE INTERFACE F. G. Bass, E. A. Kaner and L. A. Pospelov p 99-109 5 refs
8. STATIONARY SINGLE-FREQUENCY OSCILLATION MODE OF A MAGNETRON OSCILLATOR V. N. Nikonov p 110-132 9 refs
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10. INVESTIGATION OF SPACE-TIME CORRELATION FUNCTIONS OF AMPLITUDE FLUCTUATIONS IN MEASUREMENTS ON INTERSECTING PATHS A. V. Men' p 170-205 15 refs
11. INFLUENCE OF THE FLICKER EFFECT ON AMPLITUDE FLUCTUATIONS OF A VACUUM TUBE OSCILLATOR V. A. Logachev, O. D. Pozdeyev and V. S. Troitskiy p 206-214 5 refs
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15. DISPERSION EQUATION OF THE MAGNETRON V. Ya. Maleyev p 263-285 8 refs
16. SPACE CHARGE WAVES IN A SYSTEM OF ELECTRON BEAMS OF FINITE LENGTH R. A. Dudnik p 286-307 7 refs
17. METHOD OF SHIFTING THE VOLT-AMPERE CHARACTERISTICS AS APPLIED TO P-N JUNCTION S. P. Sinitsa p 308-318 3 refs
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21. ON SOME OPERATIONS REALIZED BY SEQUENTIAL DIGITAL COMPUTERS M. Ya. Eyngorin p 379-410 3 refs
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23. DEVIATIONS FROM STRUCTURAL REGULARITY OF MAGNETIC FIELD IN THE OUTER SOLAR CORONA V. V. Vitkevich p 423-430 5 refs (See N63-11527 03-05)
24. THE POSSIBILITY OF EXISTENCE OF NATURAL RADIO-EMITTING SATELLITES MOVING AROUND THE SUN V. V. Vitkevich p 431-438 2 refs (See N63-11528 03-05)
25. FREQUENCY STANDARD USING A MASER L. I. Gershteyn and V. M. Plechkov p 439-446 5 refs
26. ENERGY LOSSES OF A CHARGE MOVING OVER AN ANISOTROPIC MEDIUM F. G. Bass and S. I. Khankina p 447-454 3 refs
27. CONTRIBUTION TO AN INVESTIGATION OF OSCILLATIONS IN A SYSTEM OF TWO COUPLED NETWORKS ONE OF WHICH CONTAINS A VARIABLE CAPACITANCE N. V. Soina p 455-460 2 refs
28. RADIO EMISSION OF THE SUN ON WAVELENGTH $\lambda = 1.8$ mm N. A. Gorokhov, Yu A. Dryagin, and L. I. Fedoseyev p 461-462 2 refs (See N63-11529 03-05)
29. INFORMATION, GEOMAGNETISM AND AERONOMY, v. 1, no. 6, 1961 Abstracts of Articles p 463-470 14 refs

N63-11524 Joint Publications Research Service, Washington, D.C.

SPECTRUM OF RADIO EMISSION FROM THE DISCRETE SOURCE CASSIOPEIA-A AT LOW FREQUENCIES

Ye. V. Chayevskiy and S. Ya. Braude (Inst. of Radiophys. and Electron., Acad. of Sci. Ukrain. SSR) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 211-215 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 1-11 14 refs (See N63-11523 03-05) OTS: $6.00

The observed frequency spectrum of the discrete source Cassiopeia-A is compared with two theoretical spectra. The first spectrum

takes into account absorption in the layers of ionized hydrogen, while the second allows for the deviation of the refractive index from unity within the radiating object. It follows from this comparison that both models can serve equally well for an explanation of the experimental data. In order to ascertain which of these models is applicable, it is necessary to carry out measurements at frequencies lower than 10 Mcs. According to modern theory, the radio emission from discrete sources is connected with the emission of radio waves by relativistic electrons moving in cosmic magnetic fields. J.R.C.

N63-11525 Joint Publications Research Service, Washington, D. C.
ELECTRON DISTRIBUTION OVER THE RADIUS OF A METEOR TRAIL
V. V. Sidorov and R. Yu. Fakhrutdinov (Kazan State U.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 216-220 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 12-22 5 refs (See N63-11523 03-05) OTS: $6.00

A two-frequency method of radiodetection of meteors is discussed from the point of view of its application to the estimation of the distribution law of radial electron density in a meteor trail. In the case of overdense meteor trails, the incident wave cannot penetrate into the central region of the trail, the latter being similar to a metallic cylinder with some effective radius, depending on the radiation frequency. A method is suggested for calculating the effective radii difference at multiple frequencies. It is shown that the time dependence of the difference is closely connected with the radial distribution of electron density. Author

N63-11527 Joint Publications Research Service, Washington, D.C.
DEVIATIONS FROM STRUCTURAL REGULARITY OF MAGNETIC FIELD IN THE OUTER SOLAR CORONA
V. V. Vitkevich (Phys. Inst. im. P. N. Lebedev) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 402-403 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 423-430 5 refs (See N63-11523 03-05)
OTS: $6.00

The deviations from structural regularity of the magnetic field in the outer solar corona are investigated. The different observational results are due to different directions of sighting through the supercorona. Assuming that no rapid changes occur in the orientation of the magnetic field, the difference in the time of observations is three hours and corresponds to a relative displacement of the source with respect to the sun. It is possible that the magnetic field retains its approximately radial direction. However, the presence of an elongated plasma formation in the supercorona is closer to the earth than the scattering region and produces refraction of the radio waves. J.R.C.

N63-11528 Joint Publications Research Service, Washington, D.C.
THE POSSIBILITY OF EXISTENCE OF NATURAL RADIO-EMITTING SATELLITES MOVING AROUND THE SUN
V. V. Vitkevich (Phys. Inst. im. P. N. Lebedev) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 404-405 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 431-438 2 refs (See N63-11523 03-05)
OTS: $6.00

The possibility of the existence of plasma clouds in motion as satellites of the sun is investigated. From the height of the clouds, it is possible to calculate the period, the linear velocity, the half period, and the velocity. From these data, it is clear that the half-period of revolution can change within considerable limits. In any case, the half-period is not shorter than about two hours. To observe the indicated plasma satellites, special detailed observations are necessary, since the probability of their appearance is apparently quite low. Two or three interferometers are used to observe the satellites. J.R.C.

N63-11529 Joint Publications Research Service, Washington, D.C.
RADIO EMISSION OF THE SUN ON WAVELENGTH λ = 1.8 mm
N. A. Gorokhov, Yu. A. Dryagin, and L. I. Fedoseyev (Sci. Res. Radiophys. Inst., Gor'kiy U.). Transl. from Izvest, Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 413 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 461-462 2 refs (See N63-11523 03-05) OTS: $6.00

The radio emission from the sun at a wavelength of 1.8 mm is measured. It was found that the effective temperature of the sun is 5300° ± 700° K. Single measurements of the radio brightness of the moon were also made near the third quadrant. The value obtained for the effective temperature is 250° K. J.R.C.

N63-11530 Joint Publications Research Service, Washington, D.C.
NEWS OF HIGHER EDUCATIONAL INSTITUTIONS, MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION USSR, RADIOPHYSICS SERIES
Oct. 16, 1962 455 p 223 refs Transl. of 22 articles from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 3, 1962 p 423-614
(JPRS-15740) OTS: $23.50

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3. POSSIBILITY OF MEASURING THE ELECTRON CONCENTRATION IN THE UPPER IONOSPHERE AND INTERPLANETARY SPACE BY MEANS OF PLASMA WAVE RADIATION N. A. Mityakov and V. O. Rapoport p 103-111 5 refs (See N63-11531 03-12)
4. CONCERNING INTERACTION OF RADIO WAVES IN THE IONOSPHERE I. M. Vilenskiy p 112-123 4 refs (See N63-11532 03-12)
5. CONSERVATION OF ENERGY IN THE ELECTRODYNAMICS OF MEDIA WITH SPATIAL DISPERSION V. L. Ginzburg p 124-134 5 refs
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7. TRANSITION RADIATION IN OBLIQUE INCIDENCE V. Ye. Pafomov p 148-163 14 refs
8. SECOND APPROXIMATION TO THE PROBLEM OF PROPAGATION OF WAVES IN A MEDIUM WITH RANDOM INHOMOGENEITIES V. I. Tatarskiy p 164-202 11 refs
9. EFFECT OF CRYSTAL-LATTICE DEFECTS ON THE INTENSITY AND FORM OF NUCLEAR QUADRUPOLE RESONANCE LINES IN CRYSTALS V. S. Grechishkin and G. B. Soyfer p 203-219 9 refs
10. EFFECT OF FLUCTUATIONS OF THE PARAMETERS OF A SELF-OSCILLATOR ON ITS BEHAVIOR NEAR THE BIFURCATION POINT A. N. Malakhov p 220-233 2 refs
11. IONIZATION OSCILLATIONS IN DISCHARGES IN MIXTURES OF INERT GASES WITH MERCURY VAPOR A. A. Zaytsev and M. Ya. Vasil'yeva p 234-259 14 refs
12. APPROXIMATE ANALYSIS OF PROCESSES IN A MULTICAVITY MAGNETRON (PLANE MODEL) V. Ye. Nechayev p 260-293 6 refs
13. EFFECT OF PALMA PULSE STREAMS ON RADIO CIRCUITS WITH CAPACITIVE STORAGES. II G. A. Medvedev p 294-319 5 refs
14. EFFECT OF DELAY ON THE SYNCHRONIZATION OF SELF-OSCILLATIONS BY AN EXTERNAL PERIODIC FORCE V. P. Rubanik p 320-341 7 refs

15. STATISTICAL METHOD OF DETERMINING THE CHARACTERISTICS OF NON-ADJUSTABLE SELF-OSCILLATING SYSTEMS L. I. Gudzenko 342-378 6 refs
16. SYNTHESIS OF CERTAIN FEEDBACK CONTROL DEVICES ON THE BASIS OF SYMMETRICAL SYSTEMS OF EQUATIONS OF ALGEBRAIC LOGIC M. Ya. Eyngorin p 379-409 3 refs
17. EFFECT OF THE INTERNAL FLOW OF HEAT OF THE MOON ON ITS RADIO EMISSION V. S. Troitskiy p 410-415 8 refs (See N63-11533 03-05)
18. PRECISION MEASUREMENT OF THE RADIO EMISSION FROM THE MOON ON 9.6 cm V. D. Krotikov p 416-426 14 refs (See N63-11534 03-05)
19. SENSITIVITY OF ONE METHOD OF DETECTION V. A. Malakhov p 427-434 3 refs
20. SENSITIVITY OF RADIOMETERS WITH PARAMAGNETIC AMPLIFIERS K. S. Stankevich p 435-440 3 refs
21. OBSERVATION OF THE EMISSION LINE OF THE FORMALDEHYDE MOLECULE ON 72.8 Gcs. A. F. Krupnov and V. A. Skvortsov p 441-444 1 ref
22. INFORMATION, GEOMAGNETIZM I AERONOMIYA, v. II, No. 1, 1962 Abstracts of Articles p 445-451 12 refs

N63-11533 Joint Publications Research Service, Washington, D. C.
EFFECT OF THE INTERNAL FLOW OF HEAT OF THE MOON ON ITS RADIO EMISSION
V. S. Troitskiy (Sci. Res. Radiophys. Inst., Gor'kiy U.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 3, 1962 p 602-603 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 16, 1962 p 410-415 8 refs (See N63-11530 03-05) OTS: $23.50

A study is made of the possible effect of the internal flow of heat of the moon on its radio emission. The expected flow of heat Q is on the order of 2.5×10^{-5} cal/cm² sec, and its influence on the surface temperature is negligibly small except at the poles. The expression obtained for the heat flow is

$$Q = \frac{(T_{\lambda_2} - T_{\lambda_1})\sqrt{\Omega/2}}{(1 - R_1)\,2l_1\,(\lambda_2 - \lambda_1)}$$

where T_{λ_1} and T_{λ_2} are radio temperatures at different wavelengths, R_1 is the coefficient of power reflection from the surface, and Ω is the angle of velocity of rotation of the moon. J.R.C.

N63-11534 Joint Publications Research Service, Washington, D. C.
PRECISION MEASUREMENT OF THE RADIO EMISSION FROM THE MOON ON 9.6 cm
V. D. Krotikov (Sci. Res. Radiophys. Inst., Gor'kiy U.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 3, 1962 p 604-606 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 16, 1962 p 416-426 14 refs (See N63-11530 03-05) OTS: $23.50

A method is developed for absolute radio measurements of the radio emission from the moon that makes possible the determination of the moon's brightness and the detection of its phase variation at a 9.6 wavelength. The error in the relative measurements, characterized by the scatter of the experimental points relative to the approximating curve, is 1%. This error determines the accuracy with which the amplitude of the AC component of the radio temperature can be measured. The random error, due essentially to the noise of the apparatus and null drifts, does not exceed ±3% for each point. The greatest systematic error in the absolute measurement is due to the uncertainty in the position of the reference point for the distance from the radio telescope to the standard reference. J.R.C.

06 AUXILIARY SYSTEMS

Includes: fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters.

For primary propulsion systems see: PROPULSION

For related information see: 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; and 22 Navigation and Guidance.

N63-11511 National Aeronautics and Space Administration, Washington, D. C.
POWER FOR SPACECRAFT
Newell D. Sanders, Charles A. Barrett, Daniel T. Bernatowicz, Thomas P. Moffitt, Andrew E. Potter, Jr., and Harvey J. Schwartz 1962 27 p Papers presented at Session 0 of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-21) GPO:

CONTENTS:

1. POWER FOR SPACECRAFT N. D. Sanders, C. A. Barrett, D. T. Bernatowicz, T. P. Moffitt, A. E. Potter, Jr., and H. J. Schwartz (NASA. Lewis Research Center) 26 p

07 CHEMISTRY

Includes: chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis.

For related information see: 18 Materials, Metallic; 19 Materials, Non-metallic; and 26 Propellants and Combustion.

N63-11012 Ohio State U. Research Foundation, Columbus
ELECTRON IMPACT STUDIES OF CARBON DIOXIDE WITH OSCILLATOR STRENGTH DETERMINATIONS Scientific Report No. 5
Edwin N. Lassettre and Vincent D. Meyer Nov. 1962 30 p 14 refs
(Contract AF 19(604)-4541)
(AFCRL-62-1085)

Electron impact spectra of carbon dioxide are reported at accelerating voltages of 150, 200, 300, and 400. Since the resolution of the spectrometer is greater than in previous studies, more detail structure is observed in the spectra. A simple method of determining oscillator strengths in the spectra of molecular gases is presented, and several oscillator strengths for carbon dioxide have been determined. The results are compared with optical data. Author

N63-11020 Basel U. (Switzerland)
ABSORPTION SPECTRUM OF THE NO MOLECULE. III. THE HETEROGENEOUS PERTURBATION $H^2\Sigma$—$H'^2\pi$ Technical Note
E. Miescher and K. P. Huber Sept. 1962 21 p 9 refs
(Grant AF-EOARDC 61-19)
(AFCRL-62-1118)

A rotational analysis is presented for 2 complex bands H, H' – X observed in the NO absorption spectrum. (0,0) band at 1595 Å; (1,0) band at 1538 Å. The upper states are $H^2\Sigma^+$ and $H'^2\pi$, two nearly coinciding Rydberg-states interacting with each other in a hitherto unobserved mode. A deperturbation is carried out, and for

the first time a consistent interpretation can be given of all known Rydberg-states belonging to the first ionization limit of the NO molecule. Author

N63-11163 Pennsylvania U. Electrochemistry Lab., Philadelphia
HYDROGEN EVOLUTION: THE EFFECT OF SURFACE CONCENTRATION Final Report
J. O'M. Bockris [1962] 142 p 35 refs
(Contract Nonr-551(22))

The objective of this project is the acquisition of fundamental knowledge concerning the behavior of atomic hydrogen at corrodible metal surfaces, in particular the formation and transfer of atomic hydrogen into the bulk metal. Such knowledge is a prerequisite to the control and the final elimination of hydrogen embrittlement which causes weakening and eventual breakdown of structures in corrosive environments. The problem can be resolved into two stages. First, a knowledge of the concentration of atomic hydrogen on the surface of the corroding metal must be determined. Secondly, the rate of transfer of the hydrogen into the metal bulk under various conditions must be measured. The solution, therefore, requires first the development of new techniques whereby the necessary information may be acquired. The establishment from this data of a general theory of the kinetics of formation and transfer of atomic hydrogen into metals will then enable the development of practical methods of control of hydrogen embrittlement. Author

N63-11169 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
PHOTOCHEMICAL DECOMPOSITION OF CHLORINE MONOXIDE (PHOTOCHEMISCHE ZERSETZUNG VON CHLORMONOXYD)
M. Bodenstein and G. Kistiakowski Nov. 1962 16 p 12 refs
Transl. from Z. Phys. Chem., 116, 1925 p 371-390
(TIL/T-5316)

Decomposition of the monoxide was investigated for light of 436 mμ and also 405 mμ according to a method devised for the purpose. Decomposition is proportional to the absorbed energy; 2 molecules are decomposed by 1 quantum. The energy may be absorbed by admixed chlorine which sensitizes the decomposition of the monoxide. The temperature coefficient is 1.09 per 10°. Small amounts of chlorine dioxide are formed. This is not found spectrographically in fresh monoxide. Author

N63-11236 Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Aiken, S. C.
TECHNIQUES FOR THE DETERMINATION OF TRITIUM. A LITERATURE SEARCH
Myra S. Feldman June 1962 58 p 203 refs
(Contract AT(07-2)-1)
(DP-511) OTS: $1.25

References on the quantitative determination of tritium were compiled and arranged in an annotated bibliography. The references are limited to those pertinent to the instrumentation and techniques for tritium determination. Author

N63-11317 Resin Research Labs., Inc., Newark, N. J.
SYNTHESES OF ADDITIVES FOR IMPROVING HEAT STABILITY OF ELASTOMERIC VULCANIZATES Report No. 2
Alan E. Weinberg and Roy H. Cook Nov. 1, 1962 76 p 15 refs
(Contract DA 11-070-508-ORD-1200)

The objective of this work was to synthesize chemicals not commercially available which would function to increase the heat stability of various types of elastomers. Specifically, silicone, fluorocarbon and diene elastomers were evaluated. Two classes of compounds were selected for synthesis: 1) derivatives of dithiooxamide and 2) organometallic chelates. Details describing the synthesis of the dithiooxamide derivatives and the organometallic chelates are included. Author

N63-11346 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.
HYDRIDES OF THE TRANSITION METALS
Vera Ivanovna Mikheeva (Inst. of Gen. and Inorg. Chem. im. N. S. Kurnakov of the Acad. of Sci. USSR) Oct. 1962 206 p 678 refs
Transl. by JPRS of "Gidridy Perekhodnykh Metallov" Moscow, Publishing House of the Acad. of Sci. USSR, 1960
(AEC-TR-5224) OTS: $3.00

A survey is presented of the state of the art of the transition metal hydrides. The studies reviewed include those made by the following methods: absorption isotherms and isobars, X-ray diffraction, electron diffraction, neutron diffraction, infrared spectroscopy, and paramagnetic resonance. The theory of metal-hydrogen bonding is discussed. The existence of definite compounds in the hydride phases is shown by synthesizing MeH_2 and MeH_3 by exchange reactions from solutions. The changes occurring in the crystal lattice due to increasing hydrogen content are given. R.C.M.

N63-11416 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
PREPARATION AND STORAGE STABILITY OF HIGH-PURITY HYDRAZINE
Harold W. Lucien Repr. from J. Chem. Eng. Data, v. 7, no. 4, Oct. 1962 p 541-542 9 refs

Several procedures for concentrating aqueous solutions of hydrazine and for obtaining the anhydrous product have been described. To avoid certain hazards, low yields, and time-consuming aspects of most of these methods, a new procedure was adopted in which a commercial grade of anhydrous hydrazine was treated with calcium hydride in an inert atmosphere. Calcium hydride has been previously used to dry alkyl hydrazines. The method used in this work was relatively simple and did not require heating or refluxing of the hydrazine. The purity and stability of hydrazine obtained by the calcium hydride method were similar to the respective values found for hydrazine derived from the ammonolysis of hydrazine sulfate. Author

N63-11494 Rock Island Arsenal Lab., Ill.
POLYMERIZATION WITHIN CELLULOSE MATRICES. PART I: THE EXCHANGE REACTION BETWEEN CALCIUM AND CARBOXYL GROUPS IN CELLULOSE. PART II: NATURE OF THE STRENGTH REINFORCEMENT
E. S. Putnam Feb. 12, 1962 42 p 82 refs
(RIA-62-554) OTS: $1.25

Part I: The exchange reaction between calcium ions and the carboxyl groups on International Committee for Cellulose Analysis pulps, was investigated, using tritiated calcium acetate. Acetate ion was retained in varying amounts by all pulps indicating that monovalent as well as divalent exchange reactions take place when the salts of weak acids are passed through cellulose pulps. Two relationships were established: (1) a direct relationship between the number of oxidized (carboxyl and aldehyde) groups and the number of acid soluble pentose units in each pulp and (2) and inverse relationship between the sum of the number of acid soluble pentose and alkali soluble glucose units per oxidized group and the degree of polymerization of each pulp. A model was constructed of a supermolecule or micelle, containing 36,500 individual glucose and pentose units, which conforms to the above relationships for all pulps studied.

Part II: It was found that the strength reinforcement resulting from polymerization of monomers in nonswelling solvents in the presence of a cellulose matrix was lost with the extractable polymer. The rheological behavior of the treated material indicates that the strength reinforcement is due to additional hydrogen bonds formed between the polymer and the cellulose fiber matrix. Author

N63-11496 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
MELTING POINT MEASUREMENTS FOR THE TETRAMETHYLAMMONIUM NITRATE-NITRIC ACID SYSTEM

Burton Fine Repr. from J. Chem. and Eng. Data, v. 7, no. 4, Oct. 1962 p 494-496 9 refs

Solid-liquid equilibria between nitrate salts and anhydrous nitric acid have been studied recently for the solutes potassium nitrate and ammonium nitrate. This report presents melting point data for a chemically similar salt, tetramethylammonium nitrate. Measurements have been made over a temperature range from −74° to +52° C covering a range of salt concentrations up to about 50% by weight. Author

08 COMMUNICATIONS

Includes: communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation.

For tracking stations see: 10 Facilities.

For related information see: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation; and 22 Navigation and Guidance.

N63-11032 National Bureau of Standards, Boulder, Colo.
BIBLIOGRAPHY ON DIRECTION FINDING AND RELATED IONOSPHERIC PROPAGATION TOPICS 1955-61
Olaf D. Remmler, ed. Oct. 1962 119 p 849 refs
(NBS-TN-127) GPO: $0.60

This bibliography is an outgrowth of a conference held at the University of California at Los Angeles in June 1960 to discuss the aspects of long-range high-frequency radio propagation that affect radio location and direction finding, and the related problems of measurement and analysis. A group of the papers presented at the conference was published in the Radio Propagation Section (Section D) of the Journal of Research of the National Bureau of Standards, May - June issue, 1961. In connection with the conference the Numerical Analysis Research Staff of UCLA prepared a bibliography of published work on the conference subject covering the period 1955-1959. For this Technical Note the UCLA bibliography has been edited and extended to include some papers published in 1960 and the first half of 1961. This compilation, though by no means exhaustive, includes over 850 titles on direction finding and related topics ranging from instrumental details through observations and data analysis to theories of propagation. Author

N63-11036 Air Force Cambridge Research Labs. Electronics Research Directorate, Bedford, Mass.
SPEECH COMPRESSION STUDIES Research Note
Caldwell P. Smith Sept. 1962 12 p 6 refs
(AFCRL-62-739)

Studies of speech signal structure, and of listener responses to modified and standarized speech signals, are being performed with a special-purpose speech analysis/synthesis facility. The facilities and some findings are discussed. Author

N63-11039 Israel Inst. of Tech., Haifa
THE TRANSMISSION OF AUDIO-FREQUENCY ELECTROMAGNETIC WAVES THROUGH THE TERRESTRIAL IONOSPHERE IN THE MAGNETO IONIC MODE Technical Report No.2
G. Altman and H. Cory Apr. 25, 1962 12 p 10 refs
(Contract AF 61(052)-555)
(AFCRL-62-797)

It is found that both by day and by night a total ionospheric transmission optimum in the neighborhood of 3 to 5 kc/s exists for whistler mode propagation. Results are consistent with experimental values. Author

N63-11047 National Bureau of Standards, Boulder, Colo.
QUARTERLY RADIO NOISE DATA, MARCH, APRIL, MAY 1962 AND CORRIGENDUM FOR TECHNICAL NOTES 18-1 THROUGH 18-11
W. Q. Crichlow, R. T. Disney, and M. A. Jenkins Aug. 9, 1962 89 p 11 refs
(NBS-TN-18-14) GPO: $0.50

Radio-noise measurements made at sixteen stations in a worldwide network during the period March through May, 1962, are presented in tables giving the month-hour values of radio noise and the seasonal time-block values of radio noise for each station. The tables are based on three parameters of the noise: (1) the mean power, (2) the mean envelope voltage, and (3) the mean logarithm of the envelope voltage. The mean power averaged over several minutes is the basic parameter which is expressed as the effective antenna noise figure, F_o. The mean voltage and mean logarithm are expressed as deviations, V_d and L_d respectively, in db below the mean power. Corrections in previously published radio-noise tables are included. M.P.G.

N63-11184 Joint Publications Research Service, Washington, D. C.
RADAR INTERFERENCE AND PROTECTION AGAINST IT
Kromin Katkov Dec. 17, 1962 40 p Transl. of chapter from book "Osnovy Radiolokatsionnoy Tekhniki" p 430-467
(JPRS-16690) OTS: $3.60

This paper describes the various types of radar interference encountered in radar stations employed in the detection and observation of objects. The differences between spontaneous interference (due to atmospherics, receiver noises, local objects, etc.) and intentional interference (produced by an enemy to suppress the function of radar stations) are pointed out. The various types of interference encountered are described, and the effects they create on the screen of the radar tube in the receiving station are illustrated. Various methods for overcoming this interference are then described; these include electronic devices, special circuits, and operational techniques. Schematic and block diagrams are included. A.S.

N63-11300 Bernard Electronics Co., Washington, D. C.
A NEW MULTIPLEX TECHNIQUE FOR TELEMETRY
A. H. Ballard [1962] 22 p 2 refs Repr. of a paper delivered at the National Telemetering Conference, Washington, D. C., May 23-25, 1962

The name ORTHOMUX (meaning Orthogonal Waveform Multiplexing) has been adopted to describe a new method of multiplex transmission and reception. The principal feature which makes the ORTHOMUX concept unique is its use of orthogonal polynomial waveforms as carrier signals. Being orthogonal, the carrier signals may be transmitted simultaneously without interaction over a single wire or radio link. The polynomial waveforms which exhibit this property may be generated in a very simple way by cascading miniature circuit modules fully transistorized in design. Unlike frequency division multiplexing, ORTHOMUX derives all carriers from a single oscillator, eliminates the use of bulky iron-core inductors, and permits a reduction of unused guard spectrum. In contrast to time division multiplexing, ORTHOMUX uses a simplified form of automatic synchronization, eliminates any danger of frame slippage, and exhibits complete flexibility in the number of channels provided. In principle, the ORTHOMUX concept is applicable to any multichannel transmission system including voice communications, teletypewriter communications, telemetry, remote control, or digital data link. To demonstrate the principle, and experimental 4-channel analog system has been constructed which provides 50 cps response and 1% accuracy in all channels. Author

N63-11335 New York U. Coll. of Engineering, N. Y.
FEEDBACK COMMUNICATION SYSTEMS Summary Scientific Report
Leonard S. Schwartz Nov. 14 1962 27 p 26 refs
(Contract AF 19(604)-6168)
(AFCRL-62-921)

The contents of eleven scientific reports are described. Most of the work is included in one of three categories: (1) the theory and development of coded error-free feedback communication systems; (2) signal theory, with particular emphasis on application to feedback communications; and (3) evaluations and analyses of communication system performance. Some promising areas for future research are also given. Author

N63-11340 Texas U. Electrical Engineering Research Lab., Austin
A SOLUTION FOR *ELF* PROPAGATION IN THE EARTH-IONOSPHERE CAVITY BOUNDED BY AN INHOMOGENEOUS, ANISOTROPIC IONOSPHERIC MEDIUM
Carroll W. Chapman Oct. 31, 1962 72 p 14 refs
(Contract AF 19(604)-8038)
(Rept. 6-50; AFCRL-62-792)

Propagation of ELF waves in the earth-ionosphere cavity is considered for an inhomogeneous, anisotropic ionospheric medium. The ionosphere is characterized macroscopically by a tensor conductivity which is based on recent theoretical and experimental data of electron densities and electron collision frequencies in the altitude range 50 to 120 km. It is shown that for a plane stratified ionospheric medium, the tensor conductivity components may be approximated by rational functions of exponentials which allow solutions of the Maxwell equations to depend upon solutions of linear differential equations with polynomial coefficients. The resulting systems of equations are rather complicated; however, the problem in which the direction of propagation is perpendicular to the earth's magnetic field and parallel to the earth's surface is solved for vertically polarized waves under the assumption that the lower boundary of the ionosphere is located at approximately 75 km. The numerical results which consist of resonant frequencies and attenuation rates for frequencies below 60 cps are compared with identical quantities obtained using an homogeneous isotropic model ionosphere which has been derived elsewhere. Author

N63-11353 English Electric Aviation, Ltd., Luton (Gt. Brit.)
COMPARISON OF TELEPHONE TRANSMISSION SYSTEMS FOR SATELLITE LINKS
E. K. Sandeman and M. D. Murrell [1962] 115 p 21 refs Presented at the 13th International Astronautical Congress, Varna, Bulgaria, Sept. 24-28, 1962

Three types of telephone transmission systems were considered and compared for merit in an effort to select the most suitable one for satellite links to ground stations. The types of transmission systems considered were the single sideband system, the frequency modulation system, and the pulse code modulation system. Brief descriptions of each system are given. The factors upon which the comparisons were based were feasibility, reliability, simplicity, and economy in the satellite and on the ground, frequency bandwidth occupancy, and R.F. power handling capacity in the satellite and on the ground. From this comparison of merits, it was concluded that the multiple FM system would be accepted as model on which variations can be made to suit any particular situation. This system was also deemed suitable because it can be most economically integrated with existing landline systems and also because FM systems are available for immediate use. A.S.

N63-11410 Rome Air Development Center. Advanced Development Lab., Griffiss AFB, N. Y.
EXPERIMENTAL EVALUATION OF AN OPTIMUM DETECTOR FOR FSK TRANSMISSION THROUGH A RAYLEIGH FADING CHANNEL
Edward E. Cossette and Jack K. Wolf Nov. 1962 28 p 6 refs
(RADC-TDR-62-554)

The results of an analysis were used to specify an optimum receiver for the reception of frequency-shift-keyed signals which experience Rayleigh fading and additive Gaussian white receiver noise. This receiver was instrumented, through use of simulation techniques, to evaluate experimentally the performance of such a system. The measurements resulted in a family of curves giving the probability of transmission error as a function of the ratio of signal energy per bit to noise power density with the keying interval as a parameter. The results showed an improvement over existing FSK receivers. Author

N63-11423 Radio Corp. of America. Missile and Surface Radar Div., Moorestown, N. J.
RESULTS OF COHERENT PULSED RADAR SYSTEM DEMONSTRATION
[1962] 34 p

The unsmoothed measurement of velocity, taken at a rate of 10 samples per second while tracking the coherent pulsed beacon, demonstrated a radial-velocity measurement precision of 0.1 $\pm$0.02 ft./sec. rms with signal-to-noise ratios ranging from 10 to 15 db at the radar. The bias error of the velocity measurement is estimated to be $\pm$0.02 ft./sec. The coherent pulsed beacon which was demonstrated can be time-shared by several coherent pulsed radars, thus offering additional reliability and accuracy through data redundancy. Time-sharing also permits additional radars to be added and others deleted from the tracking complex, in order, progressively, to optimize the baseline configuration for the changing geometry along the trajectory of the vehicle being tracked. Author

N63-11457 Harvard U. Gordon Mc Kay Lab. of Applied Science, Cambridge, Mass.
FRESNAL GAIN OF APERTURE ANTENNA Scientific Report No. 13 (Series 2)
Teruzane Soejima May 21, 1962 32 p
(Contract AF 19(604)-4118)
(AFCRL-62-595)

When a transmitting aperture A_o and a receiving aperture B_o are coupled in the Fraunhofer region, the ratio of received to transmitted power is given by the Friis formula. It is well-known that the Fraunhofer gains G_{ao} and G_{bo} of A_o and B_o are constant and are determined independently. In this report, the product of the gains G_aG_b in the Fresnel region is determined as an integral over both apertures, assuming the gains G_a and G_b for A_o and B_o. It is pointed out that G_aG_b cannot generally be separated into the individual factors, but a formula similar to that of Friis still holds in the Fresnel region. The author proposes to define the "Gain-Product Reduction Factor," $\gamma_a\gamma_b$, as the ratio of G_aG_b to $G_{ao}G_{bo}$. The individual gain G_a or G_b may be determined only when A_o and B_o are identical and the illuminations of both apertures are the same. Then, the "Gain-Reduction Factor," γ, is defined as the ratio of G_a to G_{ao}. Assuming uniform amplitude and phase of illumination over A_o and B_o, $\gamma_a\gamma_b$ and γ are determined for circular and rectangular apertures. For circular apertures, the same factors are determined for a set of illuminations which approximate commonly used tapers, and the effect of defocusing the primary feed in lenses and dishes is also discussed. Author

N63-11526 Joint Publications Research Service, Washington, D. C.
USE OF LOGICAL UNITS IN A METEORIC RADAR
R. P. Chebotarev (Ryazansk Radiotech. Inst.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 2, 1962 p 397-401 Presented at the Third All-Union Seminar' on Radio Tech. Methods of Meteor Study, Moscow, 1960 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 1, 1962 p 411-422 1 ref
(See N63-11523 03-05) OTS: $6.00

The operating principle and the results of a very simple logical unit are presented. The unit decreases by a factor of one million the registered number of pulse noises and noise splashes without practical loss of reflected pulses even when the radar operates under city conditions. The possibility of more complicated logical units is considered. Author

09 ELECTRONICS

Includes: circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory.

For related information see: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N63-11014 Doucette (E. I.) Associates, Inc., Chatham, N. J.
A QUANTITATIVE STUDY OF THE EVOLUTION OF GASES FROM ELECTRON TUBES AND MATERIALS Second Scientific Report, Mar. 18 to June 18, 1962
W. J. Grubbs and G. H. Snider July 18, 1962 53 p
(Contract AF 19(628)-326)
(ARCRL-62-769)

The purpose is to achieve a higher degree of reliability in electron tubes through a better understanding of the kinds and quantities of gases which occur in these tubes. A bakeable, ultraclean high vacuum system which incorporates an omegatron mass spectrometer has been constructed; and six ionization gauges and the omegatron mass spectrometer tube have been calibrated. The calibration procedures and the results, which have been obtained, are reported. Author

N63-11031 National Bureau of Standards, Boulder, Colo.
EMISSION STABILIZATION OF THERMIONIC DIODE NOISE SOURCES
M. W. Randall and M. G. Arthur Sept. 1962 14 p 1 refs
(NBS-TN-160) GPO: $0.15

An apparatus is described which is capable of stabilizing the d.c. plate current of a temperature-limited thermionic diode noise source to better than 0.02 percent, which corresponds to a noise power stability of better than 0.001 db throughout the current range of 1 ma to 100 ma. Author

N63-10037 Air Force Cambridge Research Labs. Electronics Research Directorate, Bedford, Mass.
TUNNEL DIODES AT MICROWAVE FREQUENCIES Research Report
Gustav H. Blaeser Sept. 1962 50 p 8 refs
(AFCRL-62-579)

Tunnel diodes with their inherent negative resistance are very useful in circuits if their impedance and admittance, the region of stability, and their limitation of frequencies to operate with are known. The most important expressions for impedance and admittance as well as their derivations leading to a polynomial equation are given to indicate the region of circuit stability. An impedance diagram is shown with arbitrary values as an example. Another diagram, with notes taken from the S-plane, showing the self-resonant frequency in the tunnel diode network as a function of the sum of generator, load, and diode series resistance, demonstrates the behavior of the network. An equation for the extended self-resonant frequency in a series oscillator circuit is derived. The result of the evaluation is shown in two diagrams. Author

N63-11041 General Electric Co. Power Tube Dept., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS Scientific Report No. 14
J. H. Affleck Nov. 28, 1961 20 p 6 refs
(Contract AF 19(604)-4093)
(AFCRL-1114)

A number of dispenser cathodes have been tested in this investigation that exhibit the low work functions necessary for high-current density cathodes. Precautions may be taken to keep the evaporation rate at an acceptable level. These results suggest that a wide choice is possible in the materials capable of producing a barium dispenser cathode. Author

N63-11144 National Aeronautics and Space Administration, Washington, D. C.
TRACKING AND DATA ACQUISITION
Edmond C. Buckley *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 115-126 (See N63-11137 03-01)

The function of tracking and data acquisition is to provide the critical radiofrequency links that tie the spacecraft to the earth and make possible the transfer of information between the hostile environment of space and the laboratory. Tracking provides information on the location of a satellite, a deep-space probe, or a rocket vehicle. Telemetry is the remote measurement of events and conditions, ranging from the astronaut's blood pressure to the strength of the lunar gravitational field. Control is the ability to direct the operations of the spacecraft and of the entire network of ground stations in a flexible and responsive way to carry out the desired mission successfully. The minitrack network is for the purpose of spacecraft tracking and data acquisition. The Space Communications Operations Center, or SPACON, at Goddard, acquires the data from minitrack and then processes it. J.R.C.

N63-11149 Radio Corp. of America. Astro-Electronics Div., Princeton, N.J.
LOW-ALTITUDE REPEATER SATELLITES
Barton Kreuzer *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 175-180 (See N63-11137 03-01)

Low altitude satellites are discussed that are moving in orbits anywhere from a few hundred to more than ten thousand miles above the Earth. High-capacity microwave-repeater equipment is small enough and light enough to be carried in satellites that can be launched by presently available rockets. Such repeaters, moving in orbits a thousand or so miles up, can be seen directly and simultaneously by receiving and transmitting antennas on opposite sides of the ocean. As long as one of the satellites remains within direct line of sight of both stations, communications may be made through it in a single hop just as effectively as though there were a chain of relay stations extending across the ocean at ground level. J.R.C.

N63-11150 American Telephone and Telegraph Co., New York, N. Y.
TELSTAR PROJECT
Jean H. Felker *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 181-185 (See N63-11137 03-01)

This paper discusses the physical makeup, television and telephone functions, power supply, and the launch operations of the Telstar communication satellite. J.R.C.

N63-11151 Hughes Aircraft Co. Space Systems Div., Culver City, Calif.
SYNCHRONOUS-ORBIT COMMUNICATIONS SATELLITES
Fred P. Adler *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 187-191 (See N63-11137 03-01)

This paper discusses (1) some of the attractive features of a system using stationary or synchronous satellites, (2) some of the problem areas that are encountered in obtaining such a system, (3) the NASA Syncom program, and (4) an advanced synchronous satellite system. J.R.C.

N63-11218 Services Electronics Research Lab., Baldock (Gt. Brit.)
S.E.R.L. TECHNICAL JOURNAL, VOLUME 12, NO. 3
Oct. 1962 44 p 23 refs
CONTENTS:
1. A FIVE KILOWATT C-BAND TRAVELLING WAVE TUBE FOR THE G.P.O. 'TELSTAR' GROUND TRANSMITTER M. O. Bryant p 123-127 8 refs (See N63-11219 03-09)
2. EXCITED STATES OF COPPER IN SEMICONDUCTORS R. J. Cherry and J. W. Allen p 128-133 3 refs (See N63-11220 03-25)
3. NON-OHMIC EFFECTS IN GALLIUM ARSENIDE AT LOW TEMPERATURES D. J. Oliver p 134-139 6 refs (See N63-11221 03-25)
4. A SEMICONDUCTOR MONITOR FOR NUCLEAR RADIATIONS M. E. Moncaster, D. C. Northrop, and J. A. Raines p 140-150 6 refs (See N63-11222 03-15)

N63-11219 Services Electronics Research Lab., Baldock (Gt. Brit.)
A FIVE KILOWATT C-BAND TRAVELLING WAVE TUBE FOR THE G. P. O. 'TELSTAR' GROUND TRANSMITTER
M. O. Bryant *In its* S.E.R.L. Technical Journal, v. 12, no. 3, Oct. 1962 p 123-127 8 refs (See N63-11218 03-09)

The Goonhilly Downs transmitter for Project 'Telstar' uses the high power C.W. traveling wave amplifier with a clover-leaf slow-wave structure. This amplifier is described. Author

N63-11254 Hughes Aircraft Co., Culver City, Calif.
THE HUGHES AIRCRAFT COMPANY'S SYNCOM SATELLITE PROGRAM
C. Gordon Murphy N. Y., Am. Rocket Soc. [1962] 13 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2619-62) ARS: $0.50 members, $1.00 nonmembers

The Hughes Aircraft Company is developing for NASA the Syncom Mark I synchronous-orbit communication satellite. The first of these satellites is scheduled for launch early in 1963. Hughes is also conducting advanced technical developments leading toward a second-generation communication satellite called Syncom Mark II. This satellite will be placed in a stationary orbit and have the capacity for wideband communications. Author

N63-11255 Radio Corp. of America. Astro-Electronics Div., Princeton, N.J.
PROJECT RELAY
S. Metzger, C. Osgood, and W. Schreiner N.Y., Am. Rocket Soc. [1962] 24 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2620-62) ARS: $0.50 members, $1.00 nonmembers

This paper describes an experimental communication satellite built for NASA by RCA. The material is divided into three major areas and related subareas as follows: spacecraft, including structure, power system, thermal design, and attitude control; communications, including wideband system, telemetry, tracking and command system; system integration and test, including radiation experiments, system integration, and the testing program. Author

N63-11275 Hughes Aircraft Co., Culver City, Calif.
SURVEYOR SPACECRAFT COMMAND AND DATA HANDLING GSE
J. S. Green N. Y., Am. Rocket Soc. [1962] 23 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(Contract JPL-950056)
(ARS Paper-2692-62) ARS: $0.50 members, $1.00 nonmembers

To provide remote control of the Surveyor Spacecraft which will make a soft landing on the moon, a special set of ground support equipment has been developed. The operational requirements leading to the design of this command and data-handling equipment are discussed. The command, telemetry, and television subsystems are described, showing how the system requirements were met. Author

N63-11297 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N.Y.
FINAL REPORT ON COMPUTER CONTROLLED AND MODEL-REFERENCED ADAPTIVE FEEDBACK CONTROL SYSTEMS
J. J. Bongiorno, Jr. Oct. 31, 1962 34 p 5 refs
(Grant DA-ARO(D)-31-124-G201)
(PIBMRI-1085-62; AROD-2268-12)

A Nyquist-like stability criterion in conjunction with a simple substitution is utilized to establish convergence properties of linear time-varying systems. The results obtained are applied to a model-reference adaptive control system, and an allowable range of process gain variation is established for which system convergence within a specified time interval is guaranteed. The relationships obtained for the model-reference adaptive control system permit a complete design of the system. Author

N63-11320 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N. Y.
FEEDBACK DESIGN AND OPTIMAL CONTROL THEORY
John G. Truxal and Peter Dorato Oct. 22, 1962 8 p 14 refs Presented at the WPAFB Conf. on Optimum Synthesis, Dayton, Ohio Sept. 11-13, 1962
(AF Grant AFOSR-62-280)
(PIBMRI-1095-62; Memo-52)

The optimization techniques of Pontryagin (maximum principle) and Bellman (dynamic programing) are evaluated as feedback design tools. A discussion is presented of the advantages of optimal closed-loop (feedback) operation. An analysis is made of the feedback nature of the two optimization techniques cited and of the current computational difficulties in applying these techniques. Author

N63-11493 American Machine and Foundry Co., Alexandria, Va.
STANDARDIZATION STUDY OF COAXIAL SWITCHES Final Development Report, 1 May 1962 to 31 December 1962
Dec. 31, 1962 117 p
(Contract NObsr-87418)

A study has been made of electromechanical coaxial (rf transmission line) switches. The 470 types of coaxial switches in the military supply system were described to a major extent, a proposed general specification and a sample detail specification were developed, and a proposed description pattern for defining switches in the Federal catalog system was prepared. Much of the significant data was coordinated with cognizant military activities and industrial firms. The report includes a discussion of the procedures used and the conclusions and recommendations. Twelve tables and four appendixes provide details on specific elements of the study. Author

N63-11520 Joint Publications Research Service, Washington, D.C.
NEWS OF HIGHER EDUCATIONAL INSTITUTIONS, MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION USSR, RADIO ENGINEERING SERIES, VOL. V, NO. 3, 1962
V. S. Gorbenko et al Nov. 16, 1962 298 p 141 refs Transl. of 22 articles from Izv. Vysshikh Uchebn. Zavedenii, Radiotekhn. (Kiev), v. 5, no. 3, May-June 1962 p 301-413
(JPRS-16211) OTS: $19.75
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4. ESTIMATES OF THE MAXIMUM LIKELIHOOD PARAMETERS OF NORMAL SIGNALS P. A. Bakut p 71-81 2 refs
5. TYPICAL CELL FOR LOGICAL BLOCKS OF DIGITAL COMPUTERS G. I. Kaganova and A. A. Lukin p 82-102 5 refs
6. REDISTRIBUTION OF SIGNAL PROBABILITIES IN TRANSMISSION SYSTEMS WITH DATA PROCESSING V. A. Geranin, Uy. G. Zarenin, and M. I. Karnovskiy p 103-122 6 refs
7. INVESTIGATION OF SELF-EXCITATION CONDITIONS OF A PARAMETRON WITH VARIABLE INDUCTANCE Yu. N. Yefimov p 123-143 3 refs
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9. CALCULATION OF THE CAPACITANCE AND CHARACTERISTIC RESISTANCE OF AN ASYMMETRICAL STRIP LINE I. S. Kovalev p 173-194 7 refs
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11. DESIGN OF TWO-STAGE PULSE AMPLIFIER WITH COMPLEX FEEDBACK I. A. Dubrovskiy p 208-223 4 refs
12. USE OF ACCUMULATION EFFECT FOR THE MEASUREMENT OF THE LIFETIME OF MINORITY CARRIERS V. V. Borzenko and I. A. Ryzhak p 224-232 6 refs
13. ELECTROMAGNETIC SURFACE WAVES OVER A MULTIROW RIDGE A. S. Zav'yalov p 233-241 2 refs
14. SEMICONDUCTOR DEVICE FOR LENGTHENING PULSES E. D. Prokhorov and N. A. Shekhovtsov p 242-251 4 refs
15. ON THE DESIGN OF BUFFER AMPLIFIERS WITH ELECTRON TUBES Yu. L. Mishin p 252-261 3 refs
16. GENERATOR OF NANOSECOND PULSES WITH NONLINEAR DELAYED FEEDBACK Yu. K. Bogatyrev p 262-270 5 refs
17. ANALYSIS OF OPERATION OF A PULSE SELECTOR AS A SOURCE OF TRANSIENT NOISE IN RADIO RELAY COMMUNICATION SYSTEMS WITH TIME MULTIPLEXING OF CHANNELS A. I. Dzygalo p 271-278 1 ref
18. ONE-CHANNEL OPTIMIZER WITH SYSTEM FOR COARSE AND FINE SEARCH M. Gizek p 279-284 2 refs
19. CARBON PILE VOLTAGE STABILIZER WITH ELECTRONIC CONTROL G. S. Veksler and N. F. Vollerner p 285-293 2 refs
20. ON PHOTOELECTRIC ANALYSIS V. A. Cherepanov p 294-299 3 refs
21. CONCERNING THE ARTICLE BY M. K. BELKIN "ON THE NOISE LEVEL IN REGENERATION" V. P. Lesauskis and K. M. Barshauskas p 300-304 2 refs
22. REPLY BY THE AUTHOR M. K. Belkin p 304-305 2 refs

10 FACILITIES

Includes: airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations.

For related information see: 06 Auxiliary Systems.

N63-11052 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-18, VOLUME III FOR THE PERIOD SEPTEMBER 1, 1962 TO NOVEMBER 1, 1962. DEEP SPACE INSTRUMENTATION FACILITY
Nov. 30, 1962 78 p 10 refs
(NASA Contract NAS7-100)
(JPL Space Programs Summary 37-18, Vol. III) OTS: $7.60 ph, $2.54 mf

This report discusses space exploration programs and related supporting research and development projects. All Deep Space Instrumentation Facility stations are successfully tracking and receiving telemetry data from Mariner 2. A rubidium vapor frequency standard and synthesizer is being used to provide precision Doppler measurements at Venus distances, and noise tests have been made with parametric amplifiers. The S-band prototype RF system has been completed. Research and development has continued in the areas of low-noise systems, planetary radar, ranging, S-band Cassegrain system, and coded telemetry. Computer calculations of dish-structure deflections under gravity loads at zenith and horizontal positions have been made for the advanced antenna system. D.B.

N63-11182 Aerospace Industries Assoc. of America, Inc. Aerospace Research and Testing Comm., Wash., D.C.
SURVEY OF FACILITIES FOR SPACE ENVIRONMENT SIMULATION Summary Report, ARTC Project 6-60
R. S. Ross (Goodyear Aircraft Corp.) Apr. 1962 534 p
(ARTC-30) Available from National Standards Assoc., Inc., 1315 Fourteenth St., N.W., Wash. 5, D.C.: $7.50

A compilation of the data received from the Project 6-60 survey is presented. A list of participants is given for both the ARTC members and outside agencies. The answers to general questions concerning company policy on testing and method of acquisition of new facilities are summarized in tabular form for these participants. Author

11 FLUID MECHANICS

Includes: boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow, 03 Aerodynamics of Wings and Control Surfaces; 13 Heat Transfer; and 24 Physics, Plasma.

N63-11003 Geophysics Corp. of America, Bedford, Mass.
KINETIC METHODS AND THE FREE EXPANSION PROBLEM Scientific Report No. 7
E. T. Florance Nov. 15, 1962 38 p 17 refs
(Contract AF 19(628)-231; ARPA Order 258-61; Proj. Defender)
(GCA-TR-62-23-A; AFCRL-62-1086)

An investigation is made of various techniques used to treat rarefied gases by means of kinetic theory. Two formal parametric expansions, the Chapman-Enskog procedure and Knudsen iteration, are reviewed as applied to the single relaxation time (Krook) model. A brief presentation of the Grad moment method is given, and the thirteen-moment equations are discussed. The Krook model is formally solved, and the solution is compared with the result of the Chapman-Enskog procedure. An approximation method is suggested to account for the existence of a time-like boundary layer in solutions of the kinetic equation. The free expansion of a gas is considered, and two well-known exact solutions for the Euler and Knudsen limits are quoted. Interpolation formulas are constructed to connect exact solutions for both limits through the entire range of Knudsen number. The possibility of incorporating kinetic effects into the known solutions by using other methods is also discussed. Author

N63-11025 Argonne National Lab., Ill.
CONTRIBUTION TO THE THEORY OF TWO-PHASE, ONE-COMPONENT CRITICAL FLOW
Hans K. Fauske Oct. 1962 177 p 107 refs
(Contract W-31-109-eng-38)
(ANL-6633)

A study is made of two-phase, one-component critical flow. Theoretical expressions for the specific volume, void fraction, and slip ratio for critical steam-water mixtures are derived. The pressure profiles for runs at critical flow were all characterized by extremely steep pressure gradients near the throat. The pressure gradients are definitely finite and approach absolute maximum values. These values depend only upon critical flow rate and quality. Sonic velocities are not achieved in critical two-phase flow of steam-water mixtures. The "Homogeneous Flow Model" was found to be unsatisfactory for all critical throat pressures and qualities examined. The assumption of no slip between the phases, therefore, can be said to be definitely incorrect. The theory presented is highly valuable in determining the maximum discharge of steam-water mixtures from conduits and breaks in vessels and pipes. J.R.C.

N63-11075 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TURBULENT BOUNDARY LAYERS ON HIGHLY COOLED SURFACES AT HIGH MACH NUMBERS
Andrew F. Burke *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 704-741 22 refs (See N63-11058 03-01)
(Contract AF 40(600)-804)

The structure and integrated properties of turbulent boundary layers on highly cooled surfaces at Mach numbers up to 16 are deduced from pitot pressure surveys taken at the exit of a conical nozzle in the Cornell Aeronautical Laboratory 48" Hypersonic Shock Tunnel. It is shown that predictions of boundary-layer displacement thickness determined by using the equivalent flat-plate method and the reference temperature concept for relating compressible to incompressible skin-friction coefficients are in good agreement with the experimental data. The existence of a thick laminar sublayer at high Mach numbers and low Reynolds numbers is confirmed experimentally. Author

N63-11076 Lockheed Missiles & Space Co., Sunnyvale, Calif.
THE VISCOUS BLUNT-BODY PROBLEM
H. Hoshizaki *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 742-774 21 refs (See N63-11058 03-01)

A brief review of several papers dealing with the effect of shock-generated vorticity on stagnation-point heat transfer is presented. Shock detachment distances, velocity and enthalpy profiles, and heat-transfer rates are compared. An analysis is then presented which attempts to describe the flow around a blunt body when the shock layer is completely viscous. An integral method is employed to reduce the governing equations to a set of total differential equations which describe the shape of the shock wave. Insufficient boundary conditions exist at the stagnation point to solve the equations. The downstream boundary condition that the shock angle approach the inviscid value, or that all disturbances at large distances from the body vanish, is necessary. These boundary conditions preclude a simple solution to the viscous blunt-body problem. A method for determining an approximate solution is indicated. Author

N63-11172 General Dynamics Corp. General Atomic Div., San Diego, Calif.
COMMENTS ON THE BOUNDARY CONDITIONS AT AN ABLATING SURFACE
M. J. Nowak Nov. 6, 1962 10 p 5 refs
(Contract AF 29(601)-2207)
(GAMD-3639)

The ablation process is described as a discontinuity between the vapor and the condensed phase. The velocity s of the discontinuity is added to the equations for the conservation of mass, momentum, and energy for a one-dimensional coordinate system. Without considering the nature of the process through the discontinuity, the resulting equations describe the ablation process as a slow-moving discontinuity. The differential relation between the total pressure, temperature, and mass flow rate through the discontinuity is developed from the Clausius-Clapeyron equation. The mechanism of energy deposition to the surface is developed to show that only for exponential deposition is a completely steady-state process possible. R.C.M.

N63-11175 Minnesota U. St. Anthony Falls Hydraulic Lab., Minneapolis
A NOTE ON THE LINEAR THEORY OF TWO-DIMENSIONAL SEPARATED FLOWS ABOUT THIN BODIES
C. S. Song Aug. 1962 42 p 11 refs
(Contract Nonr-710(24))
(Technical Paper 39, Ser. B)

By using a generalized method of solution for the mixed boundary-value problem of analytic function theory, and by comparing the present method with the method of source-sink distribution and the method of analytic continuation, an attempt is made to unify the seemingly divergent development of the linear theories of thin foils with separating flows. It is shown that most of the mathematical models may be regarded as special cases of a generalized Riabouchinsky model. Author

N63-11197 Courant Inst. of Mathematical Sciences, New York U., N.Y.
ON CERTAIN FINITE DIFFERENCE SCHEMES FOR THE EQUATIONS OF HYDRODYNAMICS
John Gary Mar. 1, 1962 24 p 7 refs
(NYO-9188)

Two finite difference schemes of second order accuracy are applied to the equations of viscid and inviscid flow. The first is the Lax-Wendroff scheme, the second an iterative scheme. A stability criterion is obtained for the iterative scheme by the method of von Neumann. An empirical stability criterion is obtained for the Lax-Wendroff scheme as applied to viscid flow. The accuracy of these methods and their effectiveness for flows which contain a shock are also discussed. Author

N63-11269 General Dynamics/Astronautics, San Diego, Calif.
INSTABILITIES IN A CO-AXIAL PLASMA GUN
T. J. Gooding, B. R. Hayworth, and R. H. Lovberg N.Y., Am. Rocket Soc. [1962] 9 p 1 ref Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(Contract NAS3-2501)
(ARS Paper-2665-62) ARS: $0.50 members, $1.00 nonmembers

Configuration instabilities have been observed in a gas triggered coaxial plasma gun. Probe measurements of the azimuthal component B_θ, and axial component B_z of the magnetic field indicate that the current distribution is initially azimuthally symmetric and collapses into a spoke at a time close to current maximum. Optical data taken with a Kerr cell camera confirm this observation. The instability is found to depend on the gas distribution in the gun at the instant of firing. Author

N63-11281 Washington U. Coll. of Engineering, Seattle
TRANSPORT PROPERTIES OF LIQUIDS AND GASES AT HIGH TEMPERATURES Final Report [July 1, 1959-June 30, 1962]
Albert L. Babb Oct. 31, 1962 7 p 9 refs
(Contract DA-04-200-ORD-999 and Grant DA-ARO(D)-31-124-G107)
(AROD-2380-5)

This final report contains a summary of results obtained in research on "Transport Properties of Liquids and Gases at High Temperatures." Reprints of three publications are included. Author

N63-11287 College of Aeronautics, Cranfield (Gt. Brit.)
NON-NEWTONIAN FLOW IN INCOMPRESSIBLE FLUIDS. PART I: A GENERAL RHEOLOGICAL EQUATION OF STATE. PART II: SOME PROBLEMS IN STEADY FLOW
A. Kaye Oct. 1962 27 p 11 refs
(COA-N-134)

A rheological equation of state of the form,

$$p_{ij} - p\delta_{ij} = 2\int_{-\infty}^{t}\left\{\frac{\partial\Omega}{\partial J_1}S_{ij} - \frac{\partial\Omega}{\partial J_2}S_{ij}^{-1}\right\}dt'$$

is proposed for an incompressible material. Ω is a function of J_1 and J_2, the invariants of Cauchy-Green deformation tensor S_{ij} which relates the deformation at the present time t with that at some past time t'. Ω is also a function of t and t'. Some steady-state flow problems are solved for a material obeying this equation. It is anticipated that this equation will be of some use in investigating the flow properties of concentrated polymer solutions and polymer melts. Author

N63-11298 Brown U. Div. of Applied Mathematics, Providence, R.I.
ON THE STABILITY OF VISCOUS FLOW BETWEEN ROTATING CYLINDERS. III. THE EFFECT OF A TRANSVERSE PRESSURE GRADIENT
T. H. Hughes and W. H. Reid Nov. 1962 28 p 5 refs
(Contract Nonr 562(07))
(Tech. Rept. No. 50)

The effect of a transverse pressure gradient on the stability of Couette flow has been studied by direct numerical integration of the governing equations. For particular values of the rotation rate and pressure gradient, it is found that the curve of neutral stability has two minima and this leads to discontinuous behavior of the critical value of the wave-number. Detailed results for both the eigenvalues (Taylor number and wave-number) and the eigenfunctions (radial and transverse components of the perturbation velocity) are given for two rates of rotation. Author

N63-11304 Japan. Ministry of Transportation. Transportation Technical Research Inst., Tokyo
VELOCITY-DEFECT LAW OF TURBULENT BOUNDARY LAYER
Yutaka Shigemitsu Sept. 1962 21 p 16 refs
(Rept. 51)

Theoretical studies are made on the idealized turbulent boundary layer in which Reynolds stress and the mean velocity are assumed to have similar profiles respectively along the flow. When the transfer theory is introduced with our previously proposed relation $l/\delta \sim \sqrt{y/\delta}$ of the mixture length, the Reynolds' equations are reduced to an ordinary differential equation. The solutions expressed in a form $(\bar{U} - \bar{U}_0)/U_\tau$ are proved to include only a pressure gradient parameter $\lambda = (U_0\delta)/U_0\delta'$; and the fact is verified experimentally as well as the critical condition $\lambda \leq -0.3$ which designates the point where the shearing stress vanishes on the wall. Author

N63-11312 Stevens Inst. of Tech. Davidson Lab., Hoboken, N.J.
EXPERIMENTAL DETERMINATION OF SURFACE-PIERCING, FULLY VENTILATED HYDROFOIL STABILITY DERIVATIVES BY A FREE OSCILLATION TECHNIQUE
Gerard Fridsma and P. Ward Brown Nov. 1962 43 p 6 refs
(Contract Nonr-263-20)
(Rept. 897)

The results of an experimental evaluation of the dynamic stability derivatives of surface-piercing, fully ventilated, dihedral hydrofoils are presented, including the effects of variation in speed, trim, immersion, mass, moment of inertia and frequency of oscillation. The tests were made by the uncoupled free oscillation technique with either freedom in heave or pitch. An analysis of the results is presented on the basis of quasi-steady theory, including the derivation of a new expression for the pitch damping derivative, and is shown to be in good agreement with theoretical predictions. It is concluded that the quasi-steady theory will be adequate for all prototype designs of surface-piercing, fully ventilated hydrofoils. Author

N63-11313 Stevens Inst. of Tech. Davidson Lab., Hoboken, N.J.
HYDROFOIL MOTIONS IN IRREGULAR SEAS
Richard P. Bernicker Nov. 1962 55 p 13 refs
(Contract Nonr-263(42))
(Rept. 909)

An experiment designed to investigate the validity of linear superposition principles as applied to the irregular motions of nonventilated, dihedral hydrofoil systems in random seas was performed. Tests were first carried out on a typical tandem "V" foil system in various regular waves in both head and following seas to determine the response operator spectrum for the heaving and pitching motions. Irregular sea experiments with the same model were analyzed using spectral analysis techniques to obtain the wave spectrum and longitudinal motions spectra. Comparison between these spectra and those predicted using the regular sea response data and irregular wave spectrum indicated good agreement, with maximum deviation of about 20% in the range of significant wave energies. From this experiment, the linear superposition technique for predicting motions in random seas is seen to be valid to at least the same degree as for displacement vessels. Author

N63-11318 Polytechnic Inst. of Brooklyn, N.Y.
LAMINAR MIXING OF TWO PARALLEL STREAMS IN THE PROXIMITY OF A SEMI-INFINITE FLAT PLATE
Kaoru Toba Sept. 1962 31 p 9 refs
(Grant AF-AFOSR-1-63)
(PIBAL-641)

The laminar mixing of two parallel streams in the vicinity of a semi-infinite flat plate is studied. Attention is confined to the flow field upstream of the merging of the boundary layer flow and the mixing layer flow, where a nonviscous core can be assumed to separate these viscous regions. The relative position of two regions corresponds to the lateral deflection of the interface streamline and is uniquely determined by the compatibility condition for the first-order-induced pressure. An approximate but simple method of evaluating the velocity and shear on the interface streamline for free mixing problems is presented and its application to the present problem is discussed. Author

N63-11328 France. Ministere de l'Air, Paris
CONTRIBUTION A LA THÉORIE LINÉARISÉE DES EFFETS DE JETS MINCES ET DE CAVITATIONS—CALCUL DES ÉCOULEMENTS PAR ANALOGIE RHÉOÉLECTRIQUE [CONTRIBUTION TO THE LINEAR THEORY OF THIN JET AND CAVITATION EFFECTS—CALCULATION OF OUTFLOWS BY RHEOELECTRIC ANALOGY]
Thoai-Sum Luu Paris, Service de Documentation et d'Information Technique de l'Aéronautique (SDIT), Sept. 1962 137 p 28 refs
In French
(Its Publication Scientifique et Technique No. 389) Available from SDIT, 2, Ave. de la Porte d'Issy, Paris (15e)

In the realm of linear theory of weak perturbations, two distinct categories of the movements of a perfect incompressible fluid are discussed as to: (1) various cases of disturbed outflow due to the effect of an infinitely thin jet schematizing a blast, and (2) various cases of outflow around support obstacles with indefinite wakes or pockets of cavitation. Trans. by I.v.L.

N63-11331 Aerospace Corp. Physical Research Lab., El Segundo, Calif.

SOME RESULTS USING OPTICAL INTERFEROMETRY FOR PLASMA DIAGNOSTICS

A. F. Klein Nov. 5, 1962 10 p 4 refs
(Contract AF 04(695)-169)
(TDR-169(3210-06)TN-1; SSD-TDR-62-155)

Some preliminary results are presented utilizing optical interferometry for plasma diagnostics. A conical-driver electromagnetic shock tube generates the plasma. Interferograms of strong shock waves in H_2 illustrate the experimental techniques and indicate qualitatively the existence of operating regimes for this tube within which precursor effects are unimportant for determining gas properties behind the shock. Author

N63-11404 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

THE FLOW OF AN IDEAL DISSOCIATING GAS ABOUT A CONVEX ANGLE CORNER WITH NON-EQUILIBRIUM TAKEN INTO ACCOUNT (OBTEKANIE VYPUKLOGO UGLA IDEAL'NO DISSOTSIIRUYUSHCHIM GAZOM S UCHETOM NERAVNOVESNOSTI)

V. P. Stulov London, Ministry of Aviation, Oct. 1962 13 p 4 refs
Transl. by B. A. Woods from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 3, 1962 p 4-10
(RAE-LIB-TRANS-1012)

An approximate solution in the neighborhood of the vertex for the problem for an arbitrary angle is given, and the variation of the discontinuity in the normal derivatives of the gas-dynamic variables along the characteristic separating the uniform oncoming flow from the expansion is also considered. Author

N63-11408 Stevens Inst. of Tech., Hoboken, N.J.

ELECTROHYDRODYNAMICS OF SUPERFLUID HELIUM IN NARROW CHANNELS

W. Jim Neidhardt and Jack Fajans Repr. from Phys. Rev., v. 128, no. 2, Oct. 15, 1962 p 495-502
(NASA Grant NsG-130-61)

The flow of superfluid helium from a liquid reservoir to vacuum through a 10^{-5} cm channel, which was enhanced tenfold by an electric field of 3×10^{6} V/cm when a phase boundary occurred within the channel, was unaffected when the boundary moved past the channel and field. Superfluid flow at subcritical velocity given by $\Gamma-\Gamma_0=f(T)V^2$, when increased to critical flow under the influence of electrostrictive pressures was given by $\Gamma=|\rho_n/\rho||\eta(T_\lambda)/\eta(T)|K_n+|\rho_s/\rho|K_s$, with Γ and Γ_0 the flow with and without applied electric field, V the applied voltage, T the temperature, ρ_n and ρ_s the normal and superfluid densities, ρ the total density, η the viscosity, and K_n and K_s flows obtained from normalization of data. A coincidence was noted between a maximum at 2.08° K in the relative flow and an already reported maximum at 2.10° K in thermal boundary conduction. Any shift in the λ point induced by a macroscopic field of 1.5×10^{6} V/cm was less than 0.02° K, but displacements as great as 0.5° K were induced by use of very fine channels. Author

N63-11420 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

THE USE OF CONICAL AND CONTOURED EXPANSION NOZZLES IN HYPERVELOCITY FACILITIES

A. F. Burke and K. D. Bird July 1962 (Rev.) 54 p 20 refs For presentation at the Second Natl. Symp. on Hypervelocity Techniques, Denver, March 19 and 20, 1962
(Contracts AF 33(616)-7813 and AF 40(600)-804)
(CAL-112)

General considerations of conical and contoured hypersonic nozzles for use in hypervelocity test facilities are presented. Nozzle boundary-layer profile measurements were made from which the integrated properties of the boundary layer have been determined, and semiempirical relations for these properties are presented. Generalized curves are included that permit the rapid calculation of nozzle performance. Nozzle nonequilibrium effects are also considered. The effects of the density gradient and flow angularity on pressure, skin friction and heat-transfer distributions, and overall force and moment characteristics of simple model configurations are considered analytically using the Newtonian flow model, hypersonic small-disturbance theory, and local boundary-layer similarity. Experimental data on a delta-wing configuration tested in the CAL 48-in. Hypersonic Shock Tunnel in both conical and contoured (parallel, uniform flow) nozzles are presented. Author

N63-11424 Naval Ordnance Test Station, China Lake, Calif.

FREE-SURFACE WATER-TUNNEL TESTS OF AN UNCAMBERED BASE-VENTED PARABOLIC HYDROFOIL OF ASPECT RATIO ONE

Thomas G. Lang and Dorothy A. Daybell Sept. 1962 40 p 9 refs
(NAVWEPS-7920; NOTS-TP-2942)

Results of water-tunnel tests on the base-vented hydrofoil model show that the lift and moment coefficients and the lift coefficient derivative are all essentially independent of ventilation number and are approximately equal to coefficients of uncambered airfoils having the same aspect ratio. The drag coefficient agreed only partially with two-dimensional cavity drag theory. The maximum lift-to-drag ratio was 6.5 when fully vented and 2.4 when fully wetted. Due to the reduced blockage of the Free-Surface Water Tunnel at the California Institute of Technology, the minimum ventilation number (K) was 0.02 and the minimum airflow rate coefficient (Q'_{cr}) providing full ventilation was 0.026 (rate increasing) and 0.013 (rate decreasing). Author

N63-11429 Johns Hopkins U., Baltimore, Md.

GENERATION OF A "STRONGLY" SWIRLING JET AND PRELIMINARY EXPERIMENTS ON THE EFFECT OF ITS DEVELOPMENT OF INITIAL SWIRL DISTRIBUTION

W. G. Rose June 1962 29 p 8 refs
(Contract AF 49(638)-248)
(AFOSR-2552)

A description is given of a device designed to generate a "strongly" swirling turbulent jet with an initial swirl distribution which is roughly a vortex with a core in solid-body rotation. Experimental results are reported of measurements taken at the discharge of the unit (the jet origin) and along the axis of the jet issuing from it. All measurements were taken on the jet axis and include mean velocities, axial turbulence-intensity components, and mean static-pressure distributions. Based on the results, the device, or "swirl generator," performs successfully. Author

N63-11461 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

PRESSURE FLUCTUATIONS IN A WEAK TURBULENT FIELD WITH A UNIFORM TRANSVERSE VELOCITY GRADIENT

Robert G. Deissler Repr. from Phys. Fluids, v. 5, no. 9, Sept. 1962 2 p 4 refs Previously issued as a preprint; for abstract see N62-12803 08-11

Pressure fluctuations in a weak turbulent field with uniform transverse velocity gradients are determined by means of differential and integral equations. These equations deal with (1) the determination of instantaneous pressure, (2) the conversion to spectral form following three-dimensional Fourier transforms, and (3) the spectrum function of $\overline{p^2}$. I.v.L

N63-11500 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

GAS DYNAMICS OF CHEMICALLY-REACTING GAS MIXTURES NEAR EQUILIBRIUM

M. Lenard Dec. 1962 38 p 15 refs Presented at Symp. on Dynamics of Manned Lifting Planetary Entry, AFOSR-GE, Philadelphia, Oct. 29-31, 1962
(Contract AF 04(694)-18 and AF 04(694-222)
(R62SD985-Class I)

The general problem of flow of a chemically reacting gaseous mixture near chemical equilibrium is treated in terms of an expansion procedure. The appropriate expansion parameter is identified; the leading term in the expansion decouples the solution of the composition problem from the fluid mechanic problem; it is the well-known chemical equilibrium solution of reacting flow problems. The formal expansion procedure permits a mathematically rigorous examination of the consequences of this approximation. Author

N63-11514 National Aeronautics and Space Administration, Washington, D.C.

GAS DYNAMICS IN SPACE EXPLORATION

H. Julian Allen, Alvin Seiff, Thomas N. Canning, Glen Goodwin, and John T. Howe 1962 52 p 110 refs Papers presented at Session R of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29) (NASA-SP-24) GPO:

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1. GAS DYNAMICS PROBLEMS OF SPACE VEHICLES H. J. Allen (NASA. Ames Research Center) 16 p 26 refs
2. RECENT INFORMATION ON HYPERSONIC FLOW FIELDS A. Seiff (NASA. Ames Research Center) 13 p 32 refs
3. RECENT DEVELOPMENTS IN THE CHEMISTRY AND THERMODYNAMICS OF GASES AT HYPERVELOCITIES T. N. Canning (NASA. Ames Research Center) 8 p 15 refs
4. RECENT DEVELOPMENTS IN MASS, MOMENTUM, AND ENERGY TRANSFER AT HYPERVELOCITIES G. Goodwin and J. T. Howe (NASA. Ames Research Center) 11 p 37 refs

12 GEOPHYSICS

Includes: auroral phenomena; upper atmospheric studies; cartography; geodesy; and geomagnetism.

For Van Allen belts see: 28 Space Radiation.

For related information see: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N63-11016 Max-Planck-Institut für Chemie, Mainz (W. Germany)

CHLORINE 36 AND ARGON 39 IN METEORITES AND THE EXPOSURE AND TERRESTRIAL AGES OF IRON METEORITES Final Report

E. Vilcsek and H. Wänke 1962 45 p 41 refs
(Contract AF 61(052)-334)
(AFCRL-62-1092)

About 30 meteorites (all except 2 were iron meteorites) were analyzed for chlorine 36 and argon 39. The decay rate of chlorine 36 varied between 0 and 28 dpm/kg and for argon 39 between 0 and 23 dpm/kg. Together with the contents of stable rare gases, cosmic ray exposure ages could be calculated for the iron meteorites and varied between 4 and 700 million years; the medium octahedrites clustered around 500 million years. The terrestrial ages were also calculated and were found to be much higher than generally thought, one meteorite showing 300,000 years and another more than 1.5 million years terrestrial age. Problems about the orbits of the group of hexahedrites and about the time constancy of cosmic ray intensity are discussed. Author

N63-11021 Queen's U., Belfast (Gt. Brit.)

HELIUM IONS IN THE UPPER ATMOSPHERE

D. R. Bates and T. N. L. Patterson [1962] 26 p 12 refs
(Grant AF-EOARDC-61-16)
(AFCRL-62-1119)

Reasons are given for believing that ion-atom interchange between He^+ and N_2 is strongly endothermic but that ion-atom interchange between He^+ and O_2 is exothermic. It is concluded that the former ion-atom interchange process does not occur to an appreciable extent but that the latter may be responsible for the removal of the He^+ being produced by photoionization. Calculations are carried out on the steady state. In harmony with the prediction of Nicolet, He^+ is found to be abundant at great altitudes even if a high rate coefficient is assigned to the collision process leading to its removal. Attention is drawn to the possibility that dissociative recombination of HeO^+ is important in connection with the problem of the escape of helium into interplanetary space. Author

N63-11023 Brazil. Comissão Nacional de Atividades Espaciais

PROGRAMA DE ATIVIDADES DA CNAE PARA 1963 (A SER PARCIALMENTE IMPLEMENTADO JA EM 1962) [PROGRAM OF ACTIVITIES FOR THE CNAE FOR 1963 (TO BE PARTIALLY IMPLEMENTED IN 1962)]

July 6, 1962 56 p In Portuguese

Brazilian participation in Projects RASA (ionospheric physics), SINO (ionospheric physics), BEMA (ionospheric physics), SALA (upper-atmosphere meteorology), TRANSIT, RELAY, and in Programs SPACEWARN and MOONWATCH are reviewed. Brazilian development of small launch vehicles for scientific purposes and ancillary equipment and funding estimates are discussed. P.F.E.

N63-11033 National Bureau of Standards, Central Radio Propagation Lab., Boulder, Colo.

MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE, NO. 8—OCTOBER 1959

J. W. Wright, L. R. Wescott, and D. J. Brown Sept. 1962 56 p 5 refs
(NBS-TN-40-8) GPO: $0.35

The CRPL has initiated a program for large-scale computation of electron density profiles from ionospheric vertical soundings. Scaling is performed at field stations, permitting computation of hourly profiles at the Central Laboratory. These profiles are combined to form hourly mean quiet profiles for each station and month. Results are illustrated graphically. This report is the eighth of a series illustrating the electron density variations in the mean quiet ionosphere between latitudes 15° N and 50° N along the 75° W meridian. Author

N63-11135 Lockheed-California Co., Burbank

INFLUENCE OF GEOMETRIC ATTENUATION OF HYDROMAGNETIC WAVES ON THE SUDDEN COMMENCEMENT OF MAGNETIC STORMS Plasma Physics Report No. 1

Erich J. Stegelmann and Carl H. von Kenschitzki July 1962 48 p 7 refs
(NASA Contract NASw-256)
(LR-16085) OTS: $4.60 ph, $1.64 mf

The propagation of hydromagnetic waves in the Earth's magnetosphere is calculated by means of a ray tracing method. Graphs are presented of rays originating from discrete sources at 6 Earth radii for the equatorial and meridional planes. The geometrical attenuation of waves from two point sources is calculated, and the results are shown in graphs. The results obtained are used to discuss previously reported findings concerning the delay time and rise time of the sudden commencement of a worldwide magnetic storm. Author

N63-11167 New York U. Coll. of Engineering, N.Y.

THE WIND SPECTRA OF THE TROPOSPHERE AND LOWER STRATOSPHERE OVER NORTH AMERICA Scientific Report No. 5

Wan-cheng Chiu Sept. 1962 75 p 8 refs
(Contract AF 19(604)-6146)
(AFCRL-62-1022)

The energy- and cross-spectra of the west-east wind components and the south-north wind components were computed at several levels extending from the 950 mb level to the 50 mb level at eleven North and Central American stations and one Pacific station. It was found that the spectral intensity of the kinetic energy in general decreases with increasing frequency, that the transport of angular momentum is northward at the majority of stations, and that this transport is strongest at the 300 mb and 200 mb levels, and is carried out mostly by the low-frequency fluctuations of the motion. Author

N63-11181 Joint Publications Research Service, Washington, D.C.
SOVIET AEROLOGICAL MEASUREMENT
A|leksandr| B|oleslavovich| Kalinovskiy and N|aum| Z|inovyevich| Pinus Dec. 17, 1962 290 p 99 refs Transl. of chapters 6-9 and their respective bibliographies from book "Aerologiya, Chast' I; Metody Aerologicheskikh Izmereniy", Leningrad, Hydrometeorological Publishing House, 1961 p 302-505 and 508-512
(JPRS: 16691) OTS: $18.00

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1. CHAPTER VI. USE OF RADAR FOR AEROLOGICAL RESEARCH p 1-87
2. CHAPTER VII. AEROLOGICAL METHODS OF STUDYING CLOUDS p 88-136
3. CHAPTER VIII. METHODS FOR INVESTIGATING VERTICAL MOTION AND TURBULENCE IN THE FREE ATMOSPHERE p 137-199
4. CHAPTER IX. THE USE OF ROCKETS FOR ATMOSPHERIC RESEARCH p 200-276
5. BIBLIOGRAPHY p 277-286

N63-11188 Joint Publications Research Service, Washington, D.C.
THE THIRD INTERNATIONAL SYMPOSIUM ON THE INVESTIGATION OF COSMIC SPACE (WASHINGTON, MAY 1-8, 1962)
K. Ya. Kondrat'yev Dec. 18, 1962 27 p Transl. of articles from Usp. Fiz. Nauk (Moscow), v. 78, no. 1, Sept. 1962 p 167-179
(JPRS-16749) OTS: $2.60

This publication is a report of a Russian delegate to The Third International Symposium on the Investigation of Cosmic Space held in Washington May 1-8, 1962. A short review of the activities of scientists of different countries is given. Particular emphasis is placed on the following papers: "The Dynamics of the Upper Atmosphere" by J. Blamont (France), "The Investigation of Winds in the Upper Atmosphere Using Clouds Created by Skylark Rockets" by G. V. Groves (England), "The Structure of the Upper Atmosphere from Data of Measurements of Charged Particles Using Rockets and Explorer VIII Satellite" by R. E. Bordeau and S. I. Bauer (USA), "Solar Influence on the Air Density Close to the 200 Km Level" by G. V. Groves and D. P. McDermott (England), "Electromagnetic and Corpuscular Heating of the Upper Atmosphere" by J. G. Jacchia (USA), "Measurements of the Air Density from Observations of the NASA Satellite, Explorer IX" by W. I. O'Sullivan, C. W. Coffee and G. M. Keating (USA), "Temporal Structure of the Upper Atmosphere" by I. Harris and W. Priester (USA), "Electron Temperature and Ionosphere" by W. B. Hanson (USA) and "Currents of Meteoric Particles in the Upper Atmosphere Determined from Observations of the Solar Corona from the Stratosphere" by G. Newkirk and J. A. Eddy (USA). I.v.L.

N63-11201 Texas U. Defense Research Lab., Austin
GEOPHYSICAL INTERPRETATIONS OF POWER SPECTRAL ANALYSIS OF LOW FREQUENCY FLUCTUATIONS IN THE MAGNETOTELLURIC FIELD
Alexander A. J. Hoffman (Ph.D. Thesis) Jan. 1962 124 p 27 refs
(Contract NOrd-16498)
(Bumblebee Ser. Rept. 310)

A description of the recording equipment and geological configuration at the location of three Soviet geomagnetic observatories which participated in the IGY is followed by a discussion of the sample data-processing procedures for power spectral analysis. Theory and applications of time-domain numerical filter operators are presented. A discussion of the application of the Tukey-Blackman method of power spectral analysis to single time series is followed by its extension to cross-power spectra, coherency and phase analysis of two time series. Power spectra of the horizontal components of the magnetic field and telluric field are computed for ten-hour periods recorded on 1 and 2 September 1957 at the Soviet Geomagnetic Observatory in Tbilisi. Spectral analyses of the East-West telluric field component were carried out for simultaneous recordings of several hours duration made on 20 September 1957 at three Soviet stations: Tbilisi, Lvov, and Ashkhabad. All analyses are based on microfilm copies furnished by the IGY World Data Center A. Each power spectrum shows a frequency dependence over a frequency range of 0.03 to 7 cpks of the form $P_0 f^{-n}$ where n varies from 1.1 to 2.5. The coherency between orthogonal components of the telluric and magnetic fields is computed for the data from Tbilisi. Magnetic power spectra from USSR, Canada, Texas, and Massachusetts are plotted on a common graph to show the frequency dependence over the range 0.03 to 400 cpks. The power spectra for Tbilisi are used to compute apparent resistivity in accordance with a formula developed by Cagniard. It is found that both components of the telluric field yield a value of 6 ohm meters for the electrical resistivity of the earth. It is suggested that this value applies to depths from 70 to 700 kilometers. There is no evidence of horizontal anisotropy of the earth's resistivity. Assuming that the earth behaves as a linear filter with the variation of a horizontal component of the earth's magnetic field as the random input or driving force and the corresponding component of the telluric field as the output or resulting function, the frequency response of the earth is computed using the results of cross-spectral analysis. Resultant computation shows the earth to behave as a uniform conductor. A comparison is made between frequencies at which peaks occur in the power spectra of the magnetotelluric field and the observed modes of free oscillation of the earth. Author

N63-11240 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.
PROJECT FIREFLY, VOLUME IV
D. Golomb, ed. Aug. 1962 132 p 73 refs
(Supported by ARPA (Proj. Defender) and DASA)
(AFCRL-62-826)

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2. INITIAL EXPANSION TO AMBIENT PRESSURE OF CHEMICAL EXPLOSIVE RELEASES IN THE UPPER ATMOSPHERE G. V. Groves (University Coll., London) p 15-43 8 refs (See N63-11242 03-12)
3. MOLECULAR AND TURBULENT DIFFUSION IN THE UPPER ATMOSPHERE S. P. Zimmerman, K. S. W. Champion, and N. W. Rosenberg (AFCRL) p 45-55 9 refs (See N63-11243 03-12)
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5. UPPER ATMOSPHERE WIND MEASUREMENTS DETERMINED FROM TWELVE ROCKET MEASUREMENTS H. D. Edwards, M. M. Cooksey, R. N. Fuller, D. L. Albritton (Ga. Inst. of Tech.), and N. W. Rosenberg (AFCRL) p 69-79 7 refs (See N63-11244 03-12)
6. POSITION DETERMINATION OF ARTIFICIAL CLOUDS IN THE UPPER ATMOSPHERE D. L. Albritton, L. C. Young, H. D. Edwards, and J. L. Brown (Ga. Inst. of Tech.) p 81-86 (See N63-11245 03-12)
7. THE LIFETIME AND MOVEMENT OF ARTIFICIALLY-PRODUCED ELECTRON CLOUDS OBSERVED WITH SPACED IONOSONDES J. W. Wright (NBS, Boulder) p 87-101 6 refs (See N63-11246 03-12)

8. GENERATION OF A LUMINOUS TRAIL IN THE NIGHT SKY D. Golomb (AFCRL) p 103-111 5 refs (See N63-11247 03-12)
9. ARTIFICIAL ELECTRON REMOVAL FROM THE F-LAYER D. Golomb (AFCRL) p 113-121 8 refs (See N63-11248 03-12)
10. ANALYSIS OF A SET OF PARTIAL DIFFERENTIAL EQUATIONS REPRESENTING THE DIFFUSION-KINETICS OF NIGHT TRAIL GENERATION BY THE METHOD OF FINITE DIFFERENCES L. Sylvia, J. Miasnick, and W. McDonald (AFCRL) p 123-133 1 ref (See N63-11249 03-12)

N63-11241 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.

CHEMICAL RELEASES IN THE UPPER ATMOSPHERE (PROJECT FIREFLY). A SUMMARY REPORT

N|orman| W|olfson| Rosenberg *In its* Project Firefly, Volume IV Aug. 1962 p 1-14 18 refs (See N63-11240 03-12)

Further analysis on past Firefly experiments is summarized and future plans are outlined. It is shown that Brode's solution for blast waves in a spherical explosion can be adapted to high-altitude releases despite a released gas to ambient density ratio of 10^4 to 10^7. Above 115 km, diffusion constants measured from radial growth of Firefly releases agree with molecular diffusion constants. However, in the region 75 to 110 km, the growth of certain clouds is faster than expected by molecular diffusion and more in line with turbulent growth. It is suggested that the energy imparted from shear to large scale eddies is dissipated not only by viscous forces but also by gravity forces. It is concluded that at present state of multiple scattering theory, the radar cross sections from turbulent clouds have no direct physical meaning in terms of cloud size and electron densities. Observations from nonseeded high-explosive releases indicate that early time Doppler shifted r-f reflection is obtained due to compression of existing ambient ionization rather than direct shock ionization. Author

N63-11242 University Coll., London (Gt. Brit.)

INITIAL EXPANSION TO AMBIENT PRESSURE OF CHEMICAL EXPLOSIVE RELEASES IN THE UPPER ATMOSPHERE

G. V. Groves *In* Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass. Project Firefly, Volume IV Aug. 1962 p 15-43 8 refs (See N63-11240 03-12)

The expanded radius of a chemical cloud originating from an explosive release is derived by calculating the work done against the atmosphere during the expansion on the basis of a simplified theory which divides the expansion into three main phases. For a given explosive composition, the expanded radius, expressed in units of $(E_{oo}/p_a)^{1/3}$, where E_{oo} is explosive energy and p_a is ambient pressure, is found to be constant and independent of charge dimensions over a wide range of altitude; and good agreement is found with the observed radii of several high-altitude releases. The temperature of the expanded cloud should also be constant with respect to release height in this altitude range, and a value of 680° K is calculated for Project Firefly releases. At greater heights, the scaled radius should increase with altitude until the assumption of continuum flow breaks down. Calculations are carried out of the temperatures and radii on expansion to ambient pressure of gas clouds produced by energy releases of 10^{11} to 10^{16} ergs at heights between 60 and 160 km and for the Project Firefly releases. The time constants of thermal conduction are examined with regard to temperature equalization within the cloud and equalization with the ambient which proceeds less rapidly. For 80 to 85 km releases, conduction may be so slow that convection processes are effective. Author

N63-11243 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.

MOLECULAR AND TURBULENT DIFFUSION IN THE UPPER ATMOSPHERE

S. P. Zimmerman, K. S. W. Champion, and N|orman| W|olfson| Rosenberg *In its* Project Firefly, Volume IV Aug. 1962 p 44-55 9 refs (See N63-11240 03-12)

The diffusion of chemical clouds created in the upper atmosphere by explosive release from a rocket has been studied by photographic techniques. Some of the clouds remain spherical and expand steadily with molecular diffusion for as long as they are visible. Other clouds develop shapes determined by wind shear or turbulence, or both. Measurements of the growth rates of turbulent clouds simultaneously with measurements of shear fields, within which the clouds are placed, allows turbulent power densities to be assigned to the atmosphere. This is based upon the assumption of a certain value for R_{ϵ}, the viscous criterion for turbulence, derived in this report. Measurements of the large-scale eddy velocity and size in the region examined determine the correct value of ϵ_p (the power density of the eddy which is limited by viscosity), scale lengths, and time constants which are altitude-dependent. Author

N63-11244 Georgia Inst. of Tech., Atlanta

UPPER ATMOSPHERE WIND MEASUREMENTS DETERMINED FROM TWELVE ROCKET EXPERIMENTS

N|orman| W|olfson| Rosenberg (AFCRL), H. D. Edwards, M. M. Cooksey, R. N. Fuller, and D. L. Albritton *In* Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass. Project Firefly, Volume IV Aug. 1962 p 69-79 7 refs (See N63-11240 03-12)

A method for the measurement of wind velocities to altitudes of several hundred kilometers, the one utilized in the work reported here, makes use of artificial chemical clouds which are generated at high altitude from rockets. These clouds consist of sodium and cesium vapors and when observed under twilight conditions with the clouds in sunlight, the resonance radiation can be photographed. This technique, first demonstrated by Edwards et al. and later perfected by Manring et al. has been used to study winds and diffusion in the upper atmosphere. The wind observations reported here are for twelve rocket firings which took place during the fall of 1959 and the summer of 1960. The two-stage Nike-Cajun rocket was used for most of the flights. The rockets were fired at twilight to altitudes between 90 and 160 km and atomic clouds of cesium and sodium were created. These clouds were tracked and photographed simultaneously from four ground stations located at distances up to 200 km from the launch site. From triangulation techniques, horizontal wind velocities were determined. The data were recorded by modified K-24 aerial cameras which were equipped with Wratten filters to isolate the sodium and cesium resonance lines at 5893 Å and 8521 Å, respectively. From star background observations, cloud position as a function of time (that is, wind velocity) is then calculated by means of the Burroughs 220 digital computer. Cloud shape as a function of altitude and time is used to determine qualitatively the nature of "turbulence" in discrete altitude regions. Author

N63-11245 Georgia Inst. of Tech., Atlanta

POSITION DETERMINATION OF ARTIFICIAL CLOUDS IN THE UPPER ATMOSPHERE

D. L. Albritton, L. C. Young, H. D. Edwards, and J. L. Brown *In* Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass. Project Firefly, Volume IV Aug. 1962 p 81-86 (See N63-11240 03-12)

The position, as a function of time, of a set of recognizable points on a chemical cloud in the upper atmosphere yields the size, growth, spatial orientation, and drift of the cloud, and these data provide a basis for the study of winds, turbulence, and diffusion in the upper atmosphere. The positions of these cloud points are found by a method triangulation based on photographic data. This report will first explain the spatial intersection of lines necessary for triangulation, and then discuss the corrections that arise when this formal procedure is applied to the physical situation. Author

N63-11246 National Bureau of Standards, Boulder, Colo.
THE LIFETIME AND MOVEMENT OF ARTIFICIALLY-PRODUCED ELECTRON CLOUDS OBSERVED WITH SPACED IONOSONDES
J. W. Wright *In* Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass. Project Firefly, Volume IV Aug. 1962 p 87-101 6 refs (See N63-11240 03-12)

Observations of electron clouds in the 1960 Firefly Series, using four closely spaced ionospheric sounders are described. Movements of the clouds as deduced by these radio means correspond closely to those observed optically throughout the period when the latter was possible. Cloud lifetimes sometimes exceeded two hours under sunlit conditions but were much shorter in the absence of ionizing radiation; in either case, the cloud echoes resemble those from Sporadic E but the relationship between the two phenomena is puzzling. Evidence is given for a height-gradient of drift velocity in the range 95 to 115 km. A correspondence is noted between the cloud drift velocity pattern and the wind system calculated from geomagnetic data by the dynamo theory of the Sq current system. Author

N63-11247 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.
GENERATION OF A LUMINOUS TRAIL IN THE NIGHT SKY
D. Golomb *In its* Project Firefly, Volume IV Aug. 1962 p 103-111 5 refs (See N63-11240 03-12)

The possibility of generating a luminous trail by the release of rocket-borne chemicals into the night sky is investigated. Nitric oxide is one of the species which by reaction with ambient oxygen atoms produces light emission. A simplified model for the kinetics of diffusion and chemical reaction is presented. It is found that at about 100-km altitude the diffusion rates are not perturbed significantly by chemical reaction provided the rate constant is smaller than 10^{-13} cm^3/sec. The glow persistence is proportional to the trail diameter. For a rate constant of 10^{-16} cm^3/sec, the luminosity will drop to about half its initial value in 100 seconds in a 25-m radius trail at 100-km altitude. Author

N63-11248 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.
ARTIFICIAL ELECTRON REMOVAL FROM THE F-LAYER
D. Golomb *In its* Project Firefly, Volume IV Aug. 1962 p 113-121 8 refs (See N63-11240 03-12)

The possibility of creating a region of local low electron density in the F-region by the release of electron attaching species is investigated. Reactions based upon charge transfer with the ambient cations and subsequent dissociative recombination seem to be too slow to cause a significant perturbation due to rapid restoration of normal conditions by diffusion processes. The electron attaching reaction $SF_6 + e \rightarrow SF_6^-$, with a rate constant of $k = 10^{-7}$cm^3/sec, is apparently fast enough to attach almost all the electrons diffusing into the cloud of released sulfur hexafluoride over considerable time periods. A simplified model for the kinetics of diffusion and chemical reaction of the species involved is presented. The coupled differential equations are solved approximately by a numerical method for both spherical and trail releases. Author

N63-11249 Air Force Cambridge Research Labs. Geophysics Research Directorate, Bedford, Mass.
ANALYSIS OF A SET OF PARTIAL DIFFERENTIAL EQUATIONS REPRESENTING THE DIFFUSION-KINETICS OF NIGHT TRAIL GENERATION BY THE METHOD OF FINITE DIFFERENCES
L. Sylvia, J. Miasnick, and W. McDonald *In its* Project Firefly, Volume IV Aug. 1962 p 123-133 1 ref (See N63-11240 03-12)

Among the experiments planned by the Air Force Cambridge Research Laboratories for the 1962 FIREFLY series is the study of light emission by a chemical capsule exploding in a region above the earth surface. The task of preparing the original set of partial differential equations representing the system in a form suitable for computer solution was presented by Dr. D. Golomb of the Geophysics Research Directorate. After analysis was completed, the method of finite differences was applied to each of the equations in the set by regarding the second of two independent variables as discrete. A set of finite-difference differential equations was developed for each of the partial differential equations by considering the discrete variable at particular values. The ensemble of equations produced by these techniques was solved simultaneously on an analog computer by parallel circuits. Author

N63-11288 Oslo U. Norwegian Inst. of Cosmic Physics, Blindern
OBSERVATIONAL AND EXPERIMENTAL TESTS OF AURORAL THEORIES
Anders Omholt [1962] 33 p 88 refs
(Contract AF 61(052)-252)

This paper reviews the most recent observational results pertinent to theories on auroral primary particles in space. The available information on the properties of the primary particles derived from optical observations are discussed, along with the general morphology of aurora. Available observations and theoretical interpretations of the dynamics of aurora are reviewed and discussed. The most recent and important satellite observations of energetic particles and magnetic fields in space are described and discussed. It is concluded that although storage of particles in the radiation belts is intimately connected to the aurora, it is unlikely that aurora is due to particles which have been stored for any length of time in the earth-magnetic field, except perhaps in a few special cases. Author

N63-11323 Iowa State U., Iowa City
GEOPHYSICAL RESEARCH WITH SATELLITES INJUNS I, II, AND III
B. J. O'Brien [1962] 51 p 13 refs Presented at a Joint Meeting of the Am. Astronautical Soc. and the Am. Assoc. for the Advan. of Sci., Philadelphia, Dec. 27, 1962
(NASA Grant NsG-233-62)
(Paper 62-84; SUI-62-28) OTS: $5.60 ph, $1.73 mf

The three satellites Injun I, II, and III were designed and built to study the natural and artificial radiation belts, aurorae and airglow, and other geophysical phenomena. The satellites carry a wide array of detectors of electrons and protons of various energies, auroral photometers, and, in the case of Injun III, a V.L.F. experiment. Injun I carried thirteen particle detectors, Injun II carried five, and Injun III carries eighteen, while the number of photometers was one, two and three, respectively. Several of the scientific results from Injun I, such as the discovery and mapping of the artificial radiation belt, are discussed, and a set of abstracts of all scientific publications from Injun I is included. Author

N63-11324 Pennsylvania State U. Ionosphere Research Lab., University Park
THE RECOMBINATION COEFFICIENT OF THE NIGHTTIME F LAYER
John S. Nisbet and T. P. Quinn Jan. 15, 1963 28 p 21 refs
(NASA Grant NsG-134-61)
(Sci. Rept. 177) OTS: $2.60 ph, $1.04 mf

An investigation of recombination in the nighttime F region is described in which use was made of electron density profiles of the region up to the maximum of the layer obtained from ionosonde records. Several models of the region above the maximum were used and compared to reconstruct the entire profile. In the method described profiles of the F layer were reconstructed for several successive hours during the night. The recombination coefficient was then assumed to vary as a function of height in accordance with the scale height of either molecular oxygen or molecular nitrogen. In this way values of the recombination coefficient at 300 Km were calculated. Marked percentage changes of β with temperature were observed

which are of the same order as current estimates of the changes in neutral particle density with temperature. Estimated values of β as a function of temperature are presented. Author

N63-11345 International Society for Photogrammetry, London (Gt. Brit.)

NUMERICAL PROCEDURES IN PHOTOGRAMMETRY

A. J. van der Weele Sept. 1, 1962 16 p Presented at its Symp. on Numerical Photogrammetry, Milan, Oct. 1-5, 1962

This paper presents a review of the problems encountered in the application of numerical procedures to photogrammetry. This is done to point out subjects for discussion at the next congress. The reduction of photographic data to digital form is discussed for both visual and automatic scanning methods. R.C.M.

N63-11355 London U. Queen Mary Coll. (Gt. Brit.)

GEOMAGNETIC CONTROL OF DIFFUSION IN THE F_2 REGION OF THE IONOSPHERE. I—THE FORM OF THE DIFFUSION OPERATOR Technical Note

P. C. Kendall (Bedford Coll.) and J. E. C. Gliddon Mar. 27, 1962 14 p 11 refs Submitted for Publication

(Grant AF-EOAR-61-41)

(AFCRL-62-1061)

The mathematical form of the diffusion operator is derived for motion of electrons along the lines of force of a dipole approximation to the geomagnetic field. The earth's atmosphere is assumed to be isothermal and horizontally stratified. A table is given of the various forms of the diffusion operator in different independent coordinates. The results are applied briefly to a discussion of the form of the boundary condition at great height in the F_2 region. Author

N63-11357 National Bureau of Standards. Central Radio Propagation Lab., Boulder, Colo.

MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE, NO. 7—SEPTEMBER 1959

J. W. Wright, L. R. Wescott, and D. J. Brown Apr. 1962 57 p 5 refs

(NBS-TN-40-7; PB-151399-7) OTS: $1.50

A program for large-scale computation of electron density profiles from ionospheric vertical soundings has been initiated. Scaling is performed at field stations, permitting computation of hourly profiles. These profiles are combined to form hourly mean quiet profiles for each station and month. The results of this program for a month are illustrated graphically. This report illustrates the electron density variations in the mean quiet ionosphere between latitudes 15° N and 50° N along the 75° W meridian. Author

N63-11358 National Bureau of Standards. Central Radio Propagation Labs., Boulder, Colo.

MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE NO. 13; SUMMARY OF ONE YEAR OF DATA, MAY 1959-APRIL 1960

J. W. Wright Apr. 15, 1962 56 p 13 refs

(NASA Contract NTF-84)

(NBS-TN-40-13; PB-151399-13) OTS: $1.50

A program has been initiated for large-scale computation of electron density profiles from ionospheric vertical soundings. Scaling is performed at field stations, permitting computation of hourly profiles. These profiles are combined to form hourly mean quiet profiles for each station and month. This report is the last of a series which has illustrated the electron density variations in the mean quiet ionosphere between latitudes 15° N and 50° N along the 75° W meridian. It contains a summary of phenomena evident in the individual reports of the series, and a summary presentation of the year's data. Author

N63-11413 National Aeronautics and Space Administration, Washington, D.C.

SPACE IN GEOPHYSICS

Homer E. Newell Repr. from Trans. Amer. Geophys. Union, v. 43, no. 3, Sept. 1962 p 279-291 12 refs

The role of geophysics in the NASA space science program is reviewed to point out the importance of geophysics in the program, the contributions of the geophysicist, and the existing opportunities for him. The schedule for the space science program through 1965 is discussed. R.C.M.

N63-11414 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

VISUAL OBSERVATIONS OF NIGHTGLOW FROM MANNED SPACECRAFT

John Aloysius O'Keefe III, Lawrence Dunkelman (NASA. Goddard Space Flight Center), and Malcolm Scott Carpenter Repr. from Science, v. 138, no. 3544, Nov. 30, 1962 p 978-980 4 refs

The luminous band around the horizon noted by J. Glenn in the first U.S. manned orbital flight is attributable to airglow. Dip-of-the-horizon measurements on the star γ Ursae Majoris showed that the band is centered at an elevation of 91 kilometers or somewhat higher. The edge-on brightness of the airglow layer was 6×10^{-7} candles per square centimeter. Author

N63-11456 Pennsylvania State U. Ionosphere Research Lab., University Park

NON-LINEAR PLASMA WAVES IN A STREAMING HOMOGENEOUS, COLD IONIZED MEDIUM

O. E. H. Rydbeck Dec. 15, 1962 32 p 2 refs

(Contract AF 19(604)-8012; NSF Grant G-18983)

(Sci. Rept. 175; AFCRL-62-1093)

The research reported in this communication deals with the properties of nonlinear traveling and standing plasma waves in homogeneous, ionized cold streams. For the traveling nonlinear plasma waves it is possible to obtain direct and simple expressions (provided electronic overtaking does not occur), which relate the charge density to the true stream coordinate. This direct method is, unfortunately, not in general applicable to the practically important case of standing plasma waves—a symmetric space charge wave pair in the linear theory. There exists one exception, however, when the direct method can be applied to standing plasma waves, viz. the very special case of stream plasma resonance. In all other cases, provided there is no electronic overtaking, the indirect, but nevertheless exact, methods of Olving will have to be used. The nonlinear maximum charge peaks, or charge bunches, are shown to be rather similar for the physically otherwise quite different traveling and standing nonlinear waves. Both rapidly become very rich in harmonics as overtaking is approached. If such a stream runs through a multi-resonant system—for example, the solar corona, an ionized anisotropic medium, or a series of cavities in a microwave device—high harmonics may be excited in the system. Whether a net harmonic radiation actually takes place or not from the interacting medium is a problem of its own, difficult, and beyond the aims of the present investigation. Author

N63-11495 International Geophysical Year World Data Center A, National Academy of Sciences, Washington, D.C.

TENTH 6-MONTHLY CATALOGUE OF DATA. ROCKETS AND SATELLITES Data received by WCD-A during the Period 1 January-30 June 1962 (Supplement)

[1962] p 66-80 4 refs

The tenth 6-monthly catalog of data received by IGY World Data Center A for Rockets and Satellites has been prepared in the form of a supplement to the ninth 6-monthly catalog, which was cumulative for the period 1 July 1957 to 31 December 1961. This

catalog has been prepared and issued in accordance with the resolutions of CIG (Comité International de Géophysique) and with the "Guide to Rockets and Satellites Information and Data Exchange" adopted by COSPAR (Committee on Space Research) in May 1962. Author

N63-11499 Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE SPACE DENSITY OF ATMOSPHERIC DUST IN THE ALTITUDE RANGE 50,000 TO 90,000 FEET
Paul W. Hodge and Frances W. Wright Washington, Smithsonian Institution, 1962 13 p 7 refs Previously issued as a preprint; for abstract see N62-12846 08-08
(Contract AF 19(604)-6627)
(*Its* Contributions to Astrophysics, v. 5, no. 14) GPO: $0.30

Collections of particulate matter have been made in the altitude range from 50,000 to 90,000 feet by means of high-altitude, short-duration flights of an F-104A jet aircraft of the NASA Flight Research Center. The average space density of particles larger than 3μ in diameter is estimated to be 1000 particles per cubic meter at these altitudes. The derived space density varies considerably, as previously found for altitudes in the range from 40,000 to 50,000 feet. Only a small percentage of these particles is possibly meteoritic. Author

N63-11503 National Aeronautics and Space Administration, Washington, D.C.
GEOPHYSICS AND ASTRONOMY IN SPACE EXPLORATION
Eleanor C. Pressly, Robert E. Bourdeau, George H. Ludwig, James E. Kupperian, Jr., and Nelson W. Spencer 1962 45 p 96 refs Papers presented at Sessions F and G and of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29)
(NASA-SP-13) GPO:

CONTENTS:

1. THE SOUNDING ROCKET AS A TOOL FOR COLLEGE AND UNIVERSITY RESEARCH C. Pressly (NASA. Goddard Space Flight Center) 6 p
2. SPACE FLIGHT STUDIES OF THE IONOSPHERE R. E. Bourdeau (NASA. Goddard Space Flight Center) 13 p 40 refs
3. PARTICLES AND FIELDS RESEARCH IN SPACE F. H. Ludwig (NASA. Goddard Space Flight Center) 9 p 48 refs
4. ASTRONOMICAL RESEARCH IN SPACE J. E. Kupperian, Jr. (NASA. Goddard Space Flight Center) 7 p 8 refs
5. AERONOMY RESEARCH WITH ROCKETS AND SATELLITES N. W. Spencer (NASA. Goddard Space Flight Center) 5 p

N63-11531 Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF MEASURING THE ELECTRON CONCENTRATION IN THE UPPER IONOSPHERE AND INTERPLANETARY SPACE BY MEANS OF PLASMA WAVE RADIATION
N. A. Mityakov and V. O. Rapoport (Sci. Res. Radiophys. Inst., Gor'kiy U.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy), v. 5, no. 3, 1962 p 464-468 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 16, 1962 p 103-111 5 refs (See N63-11530 03-05) OTS: $23.50

The possibilities are discussed of measuring the electron concentration in the upper ionosphere and in interplanetary space by using the radiation from plasma waves. In the case of weak anisotropy, an expression is derived for the radiation resistance of an elementary dipole. Plots showing the frequency dependence of the radiation are presented. Author

N63-11532 Joint Publications Research Service, Washington, D.C.
CONCERNING INTERACTION OF RADIO WAVES IN THE IONOSPHERE
I. M. Vilenskiy (Novosibirsk Electrotech. Inst. of Commun.) Transl. from Izvest. Vyssh. Ucheb. Zaved., Radiofizika (Gor'kiy, USSR), v. 5, no. 3, 1962 p 468-472 *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Radiophys. Ser. Oct. 16, 1962 p 112-123 4 refs (See N63-11530 03-05) OTS: $23.50

It is shown that when two radio waves interact in the ionosphere (a "strong" amplitude modulated one and a "weak" unmodulated one), the "weak" wave becomes modulated not only in amplitude, but also in phase. Estimates of the phase-modulation index are given. It is shown that an experimental study of the phase modulation makes it possible to determine certain ionospheric parameters. Author

13 HEAT TRANSFER

Includes: ablation; cooling; heating; and other thermal effects.

For aerothermodynamics see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings and Control Surfaces.

For combustion see: 26 Propellants and Combustion.

For related information see: 11 Fluid Mechanics.

N63-11024 College of Aeronautics, Cranfield (Gt. Brit.)
HEAT TRANSFER THROUGH AN INCOMPRESSIBLE LAMINAR BOUNDARY LAYER
V. L. Shah Sept. 1962 38 p 44 refs
(COA-N-130)

The study of the boundary-layer theory has been done by reviewing briefly the boundary-layer concept, the boundary-layer equations, and the exact solutions for wedge flow. All the methods for the calculations of the heat-transfer coefficient are surveyed briefly, describing their procedure and their limitations. Author

N63-11072 General Applied Science Labs., Inc., Westbury, N.Y.
HEAT TRANSFER DUE TO THE INTERACTION BETWEEN A SWEPT PLANAR SHOCK WAVE AND A LAMINAR BOUNDARY LAYER
Anthony Martellucci and Paul A. Libby *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 593-640 14 refs (See N63-11058 03-01)
(Contract AF 33(616)-7721)

In this report, there is studied by theoretical means the interaction between a laminar boundary layer on a flat plate and a planar shock wave which is swept with respect to the flow external to the boundary layer but normal to the plate. A model for the inviscid flow is discussed first. It is shown that for a planar shock, the effect of sweep is easily included and thus that a model for two-dimensional flow is basic to the problem. The analysis is compared to available data for two-dimensional flows and shown to be in good agreement therewith. Author

N63-11074 Aeronautical Systems Div. Flight Dynamics Lab., Wright-Patterson AFB, Ohio
A CRITICAL REVIEW OF PREDICTION TECHNIQUES APPLICABLE TO RE-ENTRY VEHICLES
Richard D. Neumann and Edward T. Meleason *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 678-703 24 refs (See N63-11058 03-01)

The state of the art with regard to aerothermodynamics has progressed from the development of a rational theory for determination of stagnation point heating rates to the development of a practical lifting reentry device in less than five years time. Due to this phenomenal rate of advance, borne of necessity, the field of aerothermodynamics is today as much art as science—lacking is the ordered development of procedures necessary for the analysis of new and varied weapon systems as well as timely and meaningful tests. At the same time, new vehicles are posing problems of an increasingly diverse nature encompassing new flow regimes, new aerodynamic heating mechanisms, and new vehicle design concepts. Despite these difficulties, much has been done both theoretically and experimentally to advance the fund of knowledge concerning aerothermodynamics. This paper outlines that progress and underscores some of the problems connected with an engineering evaluation of the aerodynamic heating on arbitrary lifting reentry devices. Author

N63-11081 Boeing Co., Seattle, Wash.
METHODS AND ANALYSIS TO HEAT TRANSFER
Peter E. Grafton *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 962-993 5 refs (See N63-11058 03-01)

The purpose of this paper is to review the significant modes of heat transfer and practical methods for their analysis to determine the thermal environment of structures for advanced flight vehicles. Emphasis is placed on maximum use of simplified analysis concepts and the range of their validity. Of particular interest is the strong damping of short period transient thermal inputs, resulting in a partial decoupling of the dynamic aerothermoelastic problem. Author

N63-11082 Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio
WING LEADING EDGE OPTIMIZATION FOR GLIDE RE-ENTRY VEHICLES
Wilbur L. Hankey and Richard E. Russell (AF Inst. of Tech.) *In its* Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 994-1013 6 refs (See N63-11058 03-01)

A computer program was written to obtain the temperature distribution for a leading edge of arbitrary geometry. The program included the following mechanisms of heat transfer: convective aerodynamic heating, external radiation, conduction, and internal radiation. An investigation was made for a glide reentry vehicle on the effect of external shape, reflector shape and orientation, and variation of material properties. The analysis demonstrated that a reduction in peak temperature of about 700° F could be obtained. The variation in temperature with angle of attack at critical heating equilibrium glide was also investigated. Author

N63-11131 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL INVESTIGATION OF ABLATION
Bernard Rashis and Russel N. Hopko Washington, NASA, July 1960 41 p 25 refs
(NASA TM X-300) OTS: $4.60 ph, $1.43 mf

A procedure is described which enables the derivation of effective heats of ablation relationships for any type of boundary layer from transpiration cooling results. Such effects as the ratio of wall temperature to local stream temperature, surface radiation, and surface combustion may be included. The predicted values for a three-dimensional laminar stagnation boundary layer for Teflon material were in agreement with values derived from tests conducted at boundary-layer enthalpy potentials of 800 and approximately 7,000 Btu/lb. The predicted equilibrium surface temperatures on nonablating surfaces behind an ablating material were in agreement with the values derived from tests conducted with Inconel cylinders having Teflon hemispherical nose shapes. Author

N63-11168 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
AN INVESTIGATION OF THE INFLUENCE OF THE CIRCULATION RATE ON THE HEAT EMISSION IN THE BOILING OF LIQUIDS IN VERTICAL PIPES (ISSLEDOVANIE VLIYANIYA SKOROSTI TSIRKULYATSII NA TEPLOOTDACHU PRI KIPENII ZHIDKOSTEI V VERTIKAL'NYKH TRUBAKH)
N. Yu. Tobilevich and V. A. Chebotarev Feb. 1962 9 p 8 refs Transl. from Izvest. Vyssh. Ucheb. Zaved., Energ. (Minsk), (2), 1958 p 72-78
(TIL/T-5306)

This paper investigates the processes of heat emission during the boiling of liquids in pipes in relation to the associated hydrodynamic conditions over a sufficiently wide range of variation of heat flow and velocity of circulation; the possibility of isolated consideration of the evaporator and the preheater portions of the pipe, with the object of determining the singularities of the heat exchange in each of these portions; and the effect of changes in the rate or velocity of circulation on the heat emission from each separate portion of the pipe. Experimental data obtained for circulation rates varying over a sufficiently wide range for substantially constant mean heat flow indicate that in the region of low circulation rates, the values of which varied according to the magnitude of the heat flow, the mean values of the coefficient of heat emission are relatively low. At the same time, practically the whole pipe worked in the boiling phase, with a minimum length of the preheater section, while the intensity of heat emission over the pipe length was also variable in this case. I.v.L.

N63-11209 Aro, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF THE CONTAMINATION OF REFLECTOR SURFACES OF INFRARED RADIATORS TO BE USED IN SPACE SIMULATORS
Fred G. Sherrell Arnold Engineering Development Center, Dec. 1962 32 p 5 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-233)

During the recent operational tests at the Arnold Center of a bare-tungsten-sourced infrared radiator in high vacuum, the reflector became overcoated with a multicolored film which seriously deteriorated the efficiency of the radiator. Since the Mark I Aerospace Systems Environmental Chamber is equipped with a large number of similar infrared radiators, an investigation into the problem was felt necessary. A series of experiments of a qualitative nature was performed to determine which gases commonly found in oil-diffusion-pumped high vacuum systems were involved in the production of the contaminating film. Evidence concerning the chemical nature of the film was obtained by having a sample analyzed by electron diffraction techniques, and certain recommendations are made to help ensure the successful operation of bare-tungsten-sourced infrared radiators in high altitude test chambers. Author

N63-11235 AeroChem Research Labs., Inc., Princeton, N. J.
SCALE EFFECTS FOR NONEQUILIBRIUM CONVECTIVE HEAT TRANSFER WITH SIMULTANEOUS GAS PHASE AND SURFACE CHEMICAL REACTIONS: APPLICATION TO HYPERSONIC FLIGHT AT HIGH ALTITUDES
Daniel E. Rosner Nov. 1962 19 p 35 refs Prepared for Publication
(Contract AF 49(638)-1138)
(TP-54)

A preliminary study of scale effects and correlation techniques for heat transfer in the presence of nonequilibrium gas phase and surface atom recombination is presented. The usefulness of a linearized film theory (conductivity cell) model of the actual process for which the complete nonequilibrium solution can be written in closed form was investigated for rapidly estimating the effects of dissociation-recombination on convective heat transfer in situations of aerodynamic interest. The correspondence of film theory-boundary layer theory is established by matching film-theory results with available

boundary-layer solutions for several important limiting cases. The implications of the model with regard to hypersonic, high altitude heat transfer, and to the conjectural case of nonequilibrium regimes in hypersonic reentry are examined. A simple "combining rule" for estimating mixed-flow nonequilibrium solutions from existing computer solutions is proposed for use until such time as more accurate correlations are devised. M.P.G.

14 HUMAN BEHAVIOR

Includes: crew training and evaluation; piloting; psychological factors.

For simulators see: 10 Facilities.

For related information see: 16 Life Sciences.

N63-11200 George Washington U. Human Resources Research Office, Washington, D.C.

IMPROVING FLIGHT PROFICIENCY EVALUATION IN ARMY HELICOPTER PILOT TRAINING

George D. Greer, Jr., Wayne D. Smith, and Jimmy L. Hatfield May 1962 50 p 20 refs

(Contract DA 44-188-ARO-2)

(HumRRO-TR-77)

A method was devised for evaluating helicopter pilots' end-of-phase performance in primary helicopter training on the basis of a standard check ride evaluated with more objective measures. The measures—termed the Intermediate PPDR (Pilot Performance Description Record) and the Advanced PPDR—consist of scales for the critical maneuvers given in primary helicopter training, on which the check pilot can record his observations of each component of performance during the actual flight. The PPDR system of evaluation was found to be more reliable and diagnostic than the method used in the past. In addition to the PPDR booklet, the new system includes a training program for check pilots in the use of the PPDR, and classroom practice in scoring the PPDR's for the correction of atypical standards of evaluation. Author

N63-11262 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PROBLEMS OF ASTRONAUT SELECTION

Charles A. Berry N. Y., Am. Rocket Soc. [1962] 20 p 7 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2647-62) ARS: $0.50 members, $1.00 nonmembers

The overall human requirements involved in the selection of astronauts are discussed, related to the Mercury selection program, and compared to the complete selection program recently stated by NASA for the Mercury, Gemini, and Apollo missions. Basically, man must be capable of performing at peak efficiency the required critical mission tasks while exposed to the hazards and stresses of space flight. Aptitude and skill requirements are best met by experienced test pilots; biologic, medical, and physical requirements indicate the selection of young men, free of significant defect, disease, or any condition predisposing to future development of performance-limiting difficulties; psychologic adaptability requirements again suggest experienced jet pilots who volunteer for the program, since stress tolerance is a direct function of strength of motivation. Final selection is made by balancing the engineering/test-pilot talent of an individual against the medical qualifications. The tests which were felt to be indicative of astronaut capabilities are described, and the actual selection sequence for the Mercury astronauts and for the second group of astronauts for the proposed missions is included. M.P.G.

N63-11339 George Washington U. Human Resources Research Office, Washington, D.C.

SURVEY OF OPERATIONAL FLYING ACTIVITIES OF ROTARY WING AVIATORS

Norman W. Heimstra, Nicholas B. Louis, and Arnold R. Young Apr. 1962 75 p

(Contract DA 44-188-ARO-2)

(HumRRO-TR-75)

As part of a worldwide survey of Army aviators, 743 rotary-wing aviators completed a 166-item questionnaire, giving detailed information on their operational activities and evaluating their school and unit training. Data are presented on such topics as frequency of types of missions and of various operations or maneuvers, the flying techniques used in these operations, and type and amount of unit training received. In addition, interviews were conducted with 90 unit commanders, instructor pilots, and operations officers to obtain their evaluations of the proficiency of aviators received from the Aviation School and of the unit training given rotary-wing aviators. Author

N63-11405 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

EFFECT OF VARIATIONS OF THE DRIFT PARAMETER ON CONTROL OF A STOCHASTIC PROCESS [Final] Technical Documentary Report [August 1961-October 1961]

William H. Pearson Aug. 1962 20 p 3 refs

(MRL-TDR-62-72) OTS: $0.50

This research examines man's ability to control a simple process whose systematic drift is obscured by random variations. Of the many combinations of systematic drift and random variation possible in such a process, four were investigated experimentally. Under two of these conditions the process would, if uncorrected, tend to diverge from the control limits. Under the other two conditions the process would tend to remain within or return to the control limits. For the two "explosive" conditions an appropriate control strategy would be to correct the process before it exceeded the control limits. For the two "self-controlled" conditions an appropriate strategy would be to correct infrequently. Subjects corrected before control limits were exceeded more frequently under the "explosive" conditions than under the "self-controlled" conditions. However, under the "self-controlled" conditions the subjects corrected more frequently than necessary. This suggests that when operating a "self-controlled" process humans do not behave optimally. Author

N63-11459 George Washington U. Human Resources Research Office, Washington, D.C.

EXPERIMENTAL ASSESSMENT OF A LIMITED SENSORY AND SOCIAL ENVIRONMENT: SUMMARY RESULTS OF THE HumRRO PROGRAM Research Memorandum

Thomas I. Myers, Donald B. Murphy, Seward Smith, and Charles Windle Monterey, Calif., Army Leadership Human Research Unit, Feb. 1962 40 p 11 refs

Data from initial experiments is presented that is designed to appraise the potency of a limited sensory and social environment. Soldier volunteers were confined for a period of four days in dark quiet cubicles which were otherwise as physically comfortable as possible. The dearth of sensory experience within the cubicle contrasted markedly with the normal sensory and social experiences of the control group subject during the same period of time. It was concluded that solitude in a comfortable but monotonous sensory environment is a "stressful" experience as compared with relatively normal social and sensory experience. However, findings indicate that sensory isolation produces a picture much more complex than that of simple and consistent degradation of human functioning. Author

15 INSTRUMENTATION

Includes: design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; and sensors and transducers.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N63-11005 Autonetics. Inertial Navigation Div., Downey, Calif.
PERMANENT MAGNETS AS PRECISION INSTRUMENT ELEMENTS
W. L. Zingery Aug. 1962 65 p 22 refs
(PUB. 552-A-12)

The properties of permanent magnet materials have been investigated for their application to force-measuring instruments of high accuracy. The physics of magnetic materials is reviewed to introduce a discussion of the magnetic stability of Alnico-type magnets. Techniques for increasing the magnetic stability are described along with instrumentation for measuring the effectiveness of these techniques with a precision of 10 ppm. R.C.M.

N63-11030 Michigan U. Coll. of Engineering, Ann Arbor
FALLING-SPHERE EXPERIMENT FOR UPPER-AIR-DENSITY: INSTRUMENTATION DEVELOPMENTS Final Report
H[al] F. Schulte, D[ouglas] A. Robinson, and J[errold] L. Wagener
Apr. 1962 58 p 9 refs
(Contract AF 19(604)-6185)
(Rept. 03558-6-F; AFCRL-62-662)

The continuing development of the instrumentation for the falling-sphere experiment for upper-air density and temperature is described. A multiple-circuit cavity for the accelerometer, which permitted the elimination of the wire bobbin contact, was developed. A moving iron solenoid caging device resulted in a smaller accelerometer requiring less power than the previous model. A new Attwood's machine permitting laboratory tests at 10^{-3} g was constructed. Electronic circuits were developed to replace the intervalometer motor. Circuits were also devised to permit long transit times and to provide discrimination between start and stop pulses. Four spheres and accelerometers for flight test were constructed. Author

N63-11043 Aeronautical Research Labs., Melbourne (Australia)
AN AUTOMATIC PRESSURE RATIO INDICATOR
D. A. Secomb and J. B. Kelleher June 1962 15 p 2 refs
(ARL/A-198)

An accurate, quickly responding continuous pressure ratio indicator has been developed for use in setting and holding constant the test Mach number of the A.R.L. Transonic Wind Tunnel. The two reference pressures whose ratio is required are measured with a pair of automatic manometers of R.A.E. design. Resistance analogs of the two pressures are provided by potentiometers geared to the manometer repeater systems. These resistances are included in a self-balancing Wheatstone bridge which forms and displays their ratio automatically and continuously. Over a pressure range typical of normal tunnel operation the error can be kept to, at most, ± 0.001. This corresponds to a Mach number error of about ± 0.002 to ± 0.003. For pressures ranging up to 50 inch Hg and ratios from 0.25 to 1.00, the error in ratio indication never exceeds ± 0.003, and only rarely exceeds ± 0.002. The speed of response is high enough to make the ratio indicator a useful aid to the tunnel operator in maintaining the Mach number constant. The system described might equally well be employed for the continuous indication of the ratio of any two quantities available as resistance or shaft rotation analogs. Author

N63-11046 Naval Ordnance Test Station, China Lake, Calif.
SUMMARY OF INVESTIGATIONS OF HEAT-WAVE EFFECTS ON PHOTOGRAPHIC IMAGES
Richard B. Walton Oct. 1962 58 p 34 refs
(NOTS-TP-2754; NAVWEPS-7773)

A comprehensive report of a year's data, taken from a special range established at NOTS for study of heat wave problems, is presented. The data include micrometeorological information as well as optical and photographic results obtained at frequent time intervals at various distances and from several camera elevations. As a result of multiple correlation analyses of these data three experiments were conducted. Results of these experiments, which demonstrate that it is possible to modify the heat wave problem by application of various ground cover materials, are also presented. Author

N63-11048 Allegany Ballistics Lab., Hercules Powder Co., Cumberland, Md.
INSTRUMENT ENGINEERING REPORT. MAGNETIC MEASURING SYSTEM
A. G. Moore and G. W. Rinard Oct. 1962 9 p
(Contract NOrd-16640)
(ABL/B-22)

A magnetic measuring system having a flux sensitive head was developed for remote linear motion measurement through nonmagnetic materials. Rearrangement of the pickup head nearly cancels the effect of the ambient magnetic field of the earth and gives an output signal proportional to the flux gradient from a magnet. This output signal is a measure of the magnet position relative to the pickup head. This system may be used for displacement measurement and event sensing on rocket motors having filament-wound, glass-fiber cases providing no moving ferrous material is close to the pickup head. Author

N63-11177 California U., Berkeley. Lawrence Radiation Lab.
CONCENTRATION AND VELOCITY PROFILES IN A STEFAN DIFFUSION TUBE
Fred J. Heinzelmann, Darshanlal T. Wason, and Charles R. Wilke
Aug. 16, 1962 72 p 16 refs
(Contract W-7405-eng-48)
(UCRL-10421) OTS: $1.50

The Stefan diffusion tube has been widely used as a means of determining vapor-phase diffusion coefficients. Theoretical study and the experimental results indicate that the concentration profile is flat across the diffusion tube. The velocity profile was found to be developing from a flat one near the liquid surface to a parabolic one at the other end of the tube. However, it has been shown theoretically that the shape of the velocity profile does not affect the mass flux, provided the concentration profile is flat. Thus, diffusion data that have been calculated from Stefan diffusion tube data with the plug-flow approximation are correct. Author

N63-11190 Frankford Arsenal. Pitman-Dunn Labs., Philadelphia, Pa.
AN EXPLOSIVE-OPERATED VALVE
Warren E. Fogg Aug. 1962 20 p 2 refs
(M63-12-1)

The object of this investigation was to develop a method for rapidly stopping the flow of gas through a tube and permanently sealing the tube against further leakage. A "valve" has been developed which will close an aluminum tube (0.5 in. OD by 0.065 in. wall) in approximately 25 microseconds, giving a hermetic seal thereof. The closure is obtained by radially collapsing the tube wall under an explosive load. The rapidly moving walls meet and join to form a bond similar to a weld. Provisions are made to muffle and/or direct the blast so that two or more "valves" can be operated within inches of each other. Eight of these "valves" were used successfully as part of an experiment in conjunction with Project Gnome, an underground atomic explosion, at Carlsbad, N.M., on 10 December 1961. Author

N63-11222 Services Electronics Research Lab., Baldock (Gt. Brit.)
A SEMICONDUCTOR MONITOR FOR NUCLEAR RADIATIONS
M. E. Moncaster, D. C. Northrop and J. A. Raines *In its* S.E.R.L. Technical Journal, v. 12, no. 3, Oct. 1962 p 140-150 Submitted for Publication (See N63-11218 03-09)

A method is described for making encapsulated p-n junction radiation counters from high resistivity p-type silicon. They can be used to monitor alpha, beta, and gamma rays, with discrimination in mixed fluxes, and are sufficiently robust and reliable for use in general purpose equipment. A portable transistorized indicator unit has been designed for use with these counters incorporating a loudspeaker output and logarithmic ratemeter. The counting threshold of the instrument is reached when 70 Kev is absorbed in the depletion layer of the junction, so that all charged particles above this energy are counted. Gamma rays give Compton interactions only, with a sensitivity of about 1 mR/hr for Co^{60} gammas. The energy response of the instrument over a range of gamma photon energies has not yet been determined. Author

N63-11294 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux
SOLUTIONS APPORTÉES A QUELQUES PROBLÈMES POSÉS PAR LA DÉTERMINATION DES TEMPÉRATURES DE SURFACE [SOLUTIONS TO SOME PROBLEMS OF WALL TEMPERATURE DETERMINATION]
Jean Crabol Nov. 1962 101 p 40 refs In French; English Summary
(ONERA-TR-108)

The effect of various parameters on wall-temperature measurements by optical methods is studied. These parameters are: the emissivity of the wall, the transmission of the media crossed by the radiation beam, and the selectivity of the receiver. The measurement errors due to a lack of precise knowledge on the true values of these parameters are evaluated. Several pyrometers designed and built for this study are described as are the measurements carried out with these pyrometers. Author

N63-11296 Massachusetts Inst. of Tech. Lab for Insulation Research, Cambridge
THE MULTIPLE-CROSSED-BEAM METHOD FOR MEASURING ELECTRON-IONIZATION CROSS SECTIONS
C. E. Woodward and C. K. Crawford (D. Sc. Thesis) Nov. 1962 39 p 24 refs
(Contract AF 33(616)-8353 and Nonr-1841(10))
(Tech. Rept.-175)

A new method for measuring the absolute values of electron-ionization cross sections is proposed. The technique involves intersecting two electron beams with a single atomic beam composed of the material to be studied. Pulsing the first electron beam results in an atomic-beam modulation which may be detected by the second electron beam. Ionization cross sections may be determined if the resulting ion currents are measured and the intersection geometries known. The absolute material-flow rate may also be determined. If a mass spectrometer is provided, the technique may be used on atomic beams composed of several constituents. The absolute cross-section values and the flow rates may be calculated separately for each constituent. The preionization mass and the source temperature can also be calculated. The theory for the method has been developed, and suitable experimental apparatus has been built. The technique has been demonstrated using magnesium. In its present form the signal-to-noise ratio is poor, about 2:1, but suggestions are made which would improve it by more than two orders of magnitude. More work is required before useful cross-section data can be obtained. Author

N63-11306 France. Ministere de l'Air, Paris
CONTRIBUTION A L'ÉTUDE DE LA PHOTO-EXTENSOMÉTRIE STATIQUE ET DYNAMIQUE [CONTRIBUTION TO THE STUDY OF STATIC AND DYNAMIC PHOTO-EXTENSOMETRY]
Jean Sapaly Paris, Service de Documentation et de'Information Technique de l'Aeronautique (SDIT) [Oct.] 1962 114 p 7 refs In French
(*Its* Publication Scientifique et Technique N. T. 118) Available from SDIT, 2 Ave. de la Porte D'Issy, Paris (15e)

A photoextensometric study has been made of a coating which adheres to metal in a satisfactory manner between $-35°$ to $70°$ C. After a study of the classical measuring apparatus, a method is proposed for measuring birefringence based on the use of a rotating analyzer. The stability of the apparatus permits the statement that the birefringence of photoextensometric substances presents a phenomenon of relaxation. This conclusion was drawn from the interpretation of experimental results obtained in the static and dynamic regimes. Trans. by M.P.G.

N63-11315 Varian Associates, Palo Alto, Calif.
ROCKET-BORNE MAGNETOMETER Final Report
Robert Morris Kirtland AFB, N. Mex., Res. Directorate, Mar. 1962 27 p 1 ref
(Contract AF 29(601)-2599)
(Eng. Rept.-270-1F; AFSWC-TDR-62-25)

A summation of the theory, design, and successful operation of two rocket-borne, wide-range rubidium-vapor magnetometers is presented. Each dual-gas-cell instrument will operate continuously in ambient magnetic fields ranging in intensity from less than 100 gammas to more than 54,000 gammas. The constant-amplitude output signal varies in frequency directly with ambient field strength. Sensitivity is dependent upon the rubidium isotope employed. One magnetometer provides 6.99 cps/gamma, the other 4.67 cps/gamma. Self-oscillation has been achieved in fields greater than 1 oersted (100,000 gammas). Each instrument responds instantaneously (within limits of experimental error) to a step change in field intensity of several hundred gammas occurring in less than one microsecond. Author

N63-11421 Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.
DESIGN AND DEVELOPMENT OF 3000°F TEMPERATURE-TRANSDUCER SYSTEM Final Report
D. L. Rall Aug. 15, 1962 143 p 16 refs
(Contracts AF 33(657)-7132 and AF 33(600)-41517; P.O. 2-043005-9153)
(ATL-D-861)

The purpose of this program was to design, develop, and fabricate a transducer system, and method of installation, for measuring the skin temperature of the wing panel and leading edge of the Dyna-Soar vehicle during reentry into the earth's atmosphere. This system was intended for use in making temperature measurements during actual flight, as a means of developing a better understanding of the effect of descent rate, attack angle, and pitchup on aerodynamic heating during reentry. The specifications governing this system design, in general, require that the system be able to withstand skin temperatures up to 3000° F and lead-wire temperatures of up to 2000° F. Author

16 LIFE SCIENCES

Includes: biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness.

For related information see: 14 Human Behavior; and 28 Space Radiation.

N63-11000 Minnesota U., Minneapolis
CONTINUOUS PROPAGATION OF MICROORGANISMS
A. G. Fredrickson and H. M. Tsuchiya Aug. 10, 1962 53 p 27 refs
(NASA Grant NsG-79-60)
OTS: $5.60 ph, $1.79 mf

Equations embodying the life-cycle concept are developed for cultures of organisms which proliferate by binary fission and do not form spores. The equations are solved for the age distribution in the special case of a continuous, steady-state fermentation. Expressions for calculating gross metabolic rates and cell size distributions are derived. Finally, the stability of the steady-state fermentor is discussed. Author

N63-11002 St. Louis U., Mo.
ABSORPTION OF D-GLUCOSE BY SEGMENTS OF INTESTINE FROM ACTIVE AND HIBERNATING, IRRADIATED AND NON-IRRADIATED GROUND SQUIRRELS, *CITELLUS TRIDECEMLINEATUS*
X. J. Musacchia and D. D. Westhoff [1962] 29 p 18 refs Submitted for Publication
(NASA Grant NsG-271-62) OTS: $2.60 ph, $1.07 mf

Results are reported for experiments designed to compare active absorption of D-glucose in the intestine from active and hibernating animals, to examine the effects of whole-body irradiation on these intestinal preparations, to compare the effects of irradiation in hibernating and nonhibernating animals, and to assess the natural protection offered by hibernal torpor. *In vitro* techniques were used to prepare duodenal, jejunal and ileal sections from active and hibernating, irradiated and nonirradiated, and awakened-after-irradiation ground squirrels (*Citellus tridecemlineati*). Active transport of D-glucose occurred in all intestinal segments; segments from hibernating squirrels had increased levels of glucose absorption; segments from both hibernating and active squirrels given 2000r whole body X-irradiation showed increased levels of gluclose absorption and transport, particularly in the duodenal and ileal sections. No significant differences were noted between the animals irradiated in the active state and those awakened after irradiation. Although the fasting which accompanies hibernation may be significant in comparisons of the nonirradiated animals, whole-body irradiation accelerated the absorptive processes in all cases studied. M.P.G.

N63-11038 Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
INCREASED SKELETAL MUSCLE ACTIVITY FOLLOWING IMPACT [Interim] Technical Documentary Report
Leroy W. Rhein and Ellis R. Taylor Dec. 1962 13 p 9 refs
(ARL-TDR-62-26)

Seven male human subjects were exposed to impacts of −10 seat G_x, −20 seat G_x (400 G/second), and −20 G_x (800 G/second). An increase in skeletal muscle activity was seen following the 20 G exposures, with involuntary movements of the trunk and extremities. The activity was greater at the higher rate of onset. Possible explanations are discussed and the hypothesis of transient alteration of the central nervous system is advanced. Author

N63-11156 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
DISCUSSION OF PROJECT EXCELSIOR
Joseph W. Kittinger, Jr. *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 249-255 (See N63-11137 03-01)

Project Excelsior is reviewed and applications for the data obtained are discussed. The primary objective of the project was to demonstrate that a man, given the proper stabilization, could be afforded an escape means from altitudes in excess of 100,000 feet. The secondary objective of Project Excelsior, the protection of a man in space environment, will probably have more far-reaching consequences. R.C.M.

N63-11192 Maryland U., College Park
INJURY AND RECOVERY OF PHOTOSYNTHESIS IN CELLS OF SUCCESSIVE DEVELOPMENTAL STAGES: TEMPERATURE EFFECTS
Constantine Sorokin [1961] 27 p 16 refs Submitted for Publication
(NASA Grant NsG-70-60)
OTS: $2.60 ph, $1.01 mf

Temperature dependence of the fluctuations in photosynthetic activity in the course of a photosynthetic experiment was studied on the synchronized 4-hour cells of the high-temperature strain 7-11-05 of *C. pyrenoidosa*. Observations at 25° revealed the same fundamental pattern in changes in photosynthetic activity with time as that previously described at 39° and the same basic trends: the upward trend thought to be a reflection of the preponderance of the anabolic processes and the downward trend indicating a prevalence of the catabolic processes. Light characteristics of these trends were at 25° qualitatively similar to those at 39°, though due to temperature effects a response to the increase in light intensity was in absolute figures smaller at 25° than at 39°. Temperature dependence was clearly indicated for the upward trend. The effect of temperature on the downward trend depended on the light intensity at which it was studied. It was apparent only if cells at two different temperatures were compared also at different but physiologically comparable light intensities, that is, at intensities that stood in the same relationship to the corresponding saturating intensities. The relation of the observed phenomena to the turnover of the photosynthetic mechanism and to the general metabolic pattern in the course of cell development was discussed. Author

N63-11193 Maryland U., College Park
ENDOGENOUS METABOLISM IN ALGAE
Robert W. Krauss and Raymond A. Galloway [1962] 22 p 24 refs Submitted for Publication
(NASA Grant NsG-70-60; Contract Nonr-3916(00))
OTS: $2.60 ph, $0.86 mf

The endogenous pathways for the supply of energy to algae have been shown to be independent to those of the exogenous pathways. Furthermore, the previous growth patterns of the algae, either as heterotrophs or as autotrophs, play an important role in the type of endogenous respiration exhibited. The presence of exogenous supplies of organic carbon will also affect the utilization of endogenous reserves. The endogenous supplies of nitrogen and phosphorous have also been shown to affect the patterns of growth from the initiation of starvation to the maintenance level. Polyphosphate may play a dual role as a reserve of inorganic phosphorous and an energy source in algae, further complicating the picture of typical endogenous metabolism as different from that under adequate supplies of all nutrients. Author

N63-11194 Maryland U., College Park
CARBON DIOXIDE AND BICARBONATE IN CELL DIVISION
Constantine Sorokin [1962] 18 p 14 refs Submitted for Publication
(NASA Grant NsG-70-60)
OTS: $1.60 ph, $0.80 mf

The effects of carbon dioxide and of bicarbonate on cell division were studied on synchronized cells of the high-temperature green alga, Chlorella 7-11-05. After 7 hours of growth in nutrient medium in light, cells were centrifuged and resuspended in distilled water or in bicarbonate and placed in darkness. Atmospheric air, or a mixture of carbon dioxide and air, was bubbled through algal suspensions during the dark period. In distilled water, cells readily divided in atmospheric air but not in 1% (2.6×10^{-4} M) or in higher concentrations of carbon dioxide. The suspension of cells in bicarbonate counteracted the inhibitory action of carbon dioxide. A minimum molar concentration of bicarbonate necessary to counteract the inhibitory effect of carbon dioxide was found to be equal to the molar

concentration of carbon dioxide in the suspending fluid. The highest concentration of carbon dioxide, the adverse effect of which could not be balanced by any concentration of bicarbonate, was found to be in the vicinity of 1.3×10^{-2} M (50% CO_2 in air). Possible effects on cell division of the change in pH and the implicated role of carbon dioxide in normal and neoplastic growth were discussed. Author

N63-11195 Maryland U., College Park

THE SYNTHESIS OF STEROLS AND THE EFFECT OF STEROIDS IN *CHLORELLA*

Glenn W. Patterson (M.S. Thesis—1963) [1963] 36 p 37 refs (NASA Grant NsG-70-60)

OTS: $3.60 ph, $0.28 mf

Cells of *Chlorella pyrenoidosa* were grown autotrophically and heterotrophically in media containing 100 ppm of steroid. Steroids of the sex-hormone group were markedly inhibitory to algal growth, while the steroids of the cholesterol type and the cortisone type had little or no effect on growth. The inhibition caused by the sex-hormones seems to be due to certain structural features in the molecule and not to differential solubility. The sterols naturally occurring in bacteria-free cultures of *Chlorella pyrenoidosa* and *Chlorella vulgaris* were examined. The sterol from *Chlorella pyrenoidosa* gave a positive Rosenheim test which is indicative of a conjugated aromatic double-bond system. It had an ultraviolet absorption peak at 282 mμ and was subsequently confirmed to be ergosterol—a common sterol in lower plants. The sterol from *Chlorella vulgaris* did not contain a conjugated double-bond system. Its single aromatic double-bond was located at C-7. Subsequent chemical and physical tests proved its structure to be identical to that of chondrillasterol—a sterol whose presence in the plant kingdom has been previously demonstrated only once. Author

N63-11203 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM NAUKA I ZHIZN' [MOSCOW] (SCIENCE AND LIFE), NO. 9, SEPTEMBER 1962

O. G. Gazenko, N. N. Zhukov-Verezhnikov, and V. Ya. Kop'yev Dec. 20, 1962 25 p Transl. of two articles from p 2-10 and 15-20 (JPRS-16776) OTS: $2.60

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1. FIVE DAYS WHICH SHOOK THE WORLD O. G. Gazenko p 1-12
2. BIOLOGY AND FLIGHTS TO OUTER SPACE N. N. Zhukov-Verezhnikov and V. Ya. Kop'yev (Acad. Med. Sci. USSR) p 13-22

N63-11226 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

PHARMACOLOGY AND TOXICOLOGY OF 1,1-DIMETHYLHYDRAZINE (UDMH) [Final Report, Nov. 1960 to Feb. 1962]

Kenneth C. Back and Anthony A. Thomas Oct. 1962 12 p 8 refs (AMRL-TDR-62-118) OTS: $0.50

The acute LD_{50} of UDMH in mice, rats, dogs, and monkeys by intraperitoneal administration was found to be 125 mg/kg, 104 mg/kg, and 60 to 100 mg/kg, respectively. All animals exhibited clonic-tonic convulsions as the predominant symptom, and death was via respiratory arrest. Dogs and monkeys routinely showed emesis within 15 to 60 minutes following dose of UDMH, regardless of route. In the anesthetized dog UDMH did not alter the effects of epinephrine, norepinephrine, acetylcholine, histamine, or reserpine on blood pressure. It did not significantly affect autonomic ganglia or postganglionic nerve endings, nor did it markedly alter the electrocardiogram or blood pressure in 1 to 2 hours. In the unanesthetized dog, however, blood pressure was significantly increased until convulsions and respiratory arrest occurred. Author

N63-11261 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MINIMUM CREW SPACE HABITABILITY FOR THE LUNAR MISSION

George A. Rathert, Jr., Norman M. McFadden, Richard F. Weick, R. Mark Patton, Glen W. Stinnett, and Terence A. Rogers N.Y., Am. Rocket Soc. [1962] 34 p 100 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2644-62) ARS: $0.50 members, $1.00 nonmembers

Two experienced and highly motivated test subjects, a NASA test pilot and a physiologist performed a 4-hour-on, 4-hour-off work schedule for 7 days in a capsule providing 61.5 cubic feet per man. The purpose was to consider the feasibility of reducing the booster requirements for the lunar mission by using only a two-man crew and a small capsule. The subject performed a work schedule comprised of engineering, psychological and physiological monitoring, and research tasks. The effects of the stresses produced by the small size of the work space and by the work schedule were studied. The ecological system was not closed and a "shirt sleeve" environment was provided. Pending a more detailed scrutiny of the data, the two most serious problems within the scope of the experiment were an indication of increasing loss in skeletal calcium and the difficulty of one subject in remaining awake on the 0400-0800 shift at the existing level of motivation. Author

N63-11326 Florida State U. Inst. for Space Biosciences, Tallahassee

EFFECTS OF THE GRAM STAIN ON MICROSPHERES FROM THERMAL POLYAMINO ACIDS

Sidney W. Fox and Shuhei Yuyama [1962] 18 p 2 refs Presented at the Conf. on Problems of Environmental Control on the Morphology of Fossil and Recent Protobionta at the N.Y. Acad. of Sci., May 1, 1962 Submitted for Publication

(NASA Grant NsG-173-62; NIH Grant C-3971(04))

OTS: $1.60 ph, $0.80 mf

Microspheres produced from acid proteinoid accept the gram stain. The stain is negative, but microspheres produced from mixtures containing a sufficient proportion of lysine proteinoid stain positive. Microspheres produced from mixtures containing the appropriate proportions contain individual variations which stain positive and others which stain negative. Author

N63-11341 North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.

POTASSIUM SUPEROXIDE CANISTER EVALUATION FOR MANNED SPACE VEHICLES [Final Report]

A. W. Optican Wright-Patterson AFB, Ohio, Flight Accessories Lab., Sept. 1962 293 p 66 refs

(Contract AF 33(616)-8323)

(NA-62-283; ASD-TDR-62-583)

New experimental techniques, and their results, used to develop and evaluate the effects of simultaneous multiple operating parameters on potassium superoxide (KO_2) canisters for life support systems in manned space vehicles, are presented. Actual experiments using rodents, men, and simulated-man, are described and compared. Experimental characteristics of single and dual canister (demand) atmosphere composition control systems are analyzed. The best method for experimental definitive Respiratory Quotient matching is described. A new annular screen device for a chemical canister which prevents blocking of the airflow in a granular solid chemical bed due to high absolute humidity is shown and described. A canister design method was developed to determine basic KO_2 canister sizes for atmosphere composition control system tests on a real-time, one-man basis. The dominant role of PCO_2 in establishing the CO_2 adsorption rate and the O_2 generation rate is shown, as well as the roles of absolute humidity and catalysts in establishing the O_2 generation

rate. Empirical induction was used to try and substantiate (unsuccessfully) a previously accepted theoretical equation of a KO_2 bed. A series of comparative tables and curves has been analytically and experimentally derived for O_2-CO_2 generation and adsorption support levels for one man. Author

N63-11359 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

A SOLID STATE MEASURING DEVICE FOR GALVANIC SKIN RESPONSE [Final Report, Dec. 1961-May 1962]

Adolph R. Marko, Miles A. Mc Lennan, and Edward G. Correll Oct. 1962 13 p 6 refs
(AMRL-TDR-62-117) OTS: $0.50

The problem of monitoring galvanic skin resistance, especially when used in combination with electrocardiographic or electroencephalographic recordings, is discussed. A new approach is outlined that eliminates interference from other measurements. A small, lightweight laboratory model has been built that has low power consumption and is insensitive to vibration and acceleration forces. The performance, stability, and accuracy of the model is equivalent to larger, more conventional instruments used for the same purpose. Author

N63-11402 Florida State U. Inst. for Space Biosciences, Tallahassee

EXPERIMENTS SUGGESTING ORIGINS OF AMINO ACIDS AND PROTEINS

Sidney W. Fox [1962] 24 p 36 refs Submitted for Publication
(NASA Grant NsG-173-62 and NIH Grant C-3971)
(Its Contribution 6) OTS: $2.60 ph, $0.92 mf

The origin of proteinaceous life by simple spontaneous processes is reviewed; and Darwinian considerations (molecular evolution) are applied so as to understand protein heterogeneity. When compounds of carbon, hydrogen, oxygen, and nitrogen are present with a sufficient release of energy, amino acids inexorably result and aspartic acid is found to be a substantial component of the reaction products. When a sufficient quantity of aspartic acid is dry heated with all of the other amino acids, the products obtained contain all of the amino acids plus amide groups, have mean molecular weights as high as 8000, exhibit peptide bonding, and have many physical and chemical properties in common with proteins. Thus, methods simple enough to have been spontaneous yield polyamino acids as complex or more complex than proteins. Results with nucleotides also suggest that highly complex macromolecules can arise from relatively simple micromolecules by very simple processes. Research on thermal origins of micromolecules and macromolecules has led to a model of the origin of organized units. When water is introduced into the reaction mixture, microspheres having the size and shape of cocci are formed. These microspheres can be centrifuged without losing their integrity and exhibit gram-negative or gram-positive characteristics. M.P.G.

N63-11426 St. Louis U., Mo.

ACTIVE ABSORPTION OF D-GLUCOSE BY INTESTINAL SEGMENTS OF THE GROUND SQUIRREL, CITELLUS TRIDECEMLINEATUS

X. J. Musacchia and S. S. Neff [1962] 12 p 14 refs Submitted for Publication
(NASA Grant NsG-271-62)
OTS: $1.60 ph, $0.80 mf

Active absorption of D-glucose by intestinal segments of *Citellus tridecemlineatus* was shown using *in vitro* preparations where the starting concentration was 1 mg/ml on each side of the intestinal wall. The intestine, *in vitro*, showed a marked ability to absorb, accumulate, and retain D-glucose. Author

N63-11465 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

BIOLOGISTICS FOR SPACE SYSTEMS SYMPOSIUM, DAYTON, OHIO, MAY 1-3, 1962 [Final Report]

Joan Robinette, ed. Oct. 1962 420 p 361 refs
(AMRL-TDR-62-116) OTS: $6.00

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N63-11466 Texas U., Austin

THE ALGAL PHOTOSYNTHETIC GAS EXCHANGER

Jack Myers *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 5-7 1 ref (See N63-11465 03-16)
OTS: $6.00

Use of an algal photosynthetic gas exchanger to satisfy human respiratory requirements in a space cabin is considered. Algae are considered to be the best plant for use in steady-state operations requiring a stoichiometric relationship between oxygen production, carbon dioxide utilization, and production of organic plant material. However, performance estimates for an algal gas exchanger vary within a tenfold range. In addition, model systems are still to be designed to enable determining what kind of performance can really be achieved. Also, the minimum requirements and the maximum performance characteristics for the exchanger must still be determined. B.J.C.

N63-11467 Boeing Co., Seattle, Wash.

LARGE ALGAL SYSTEMS

H. H. Bovee, A. J. Pilgrim, L. S. Sun, J. E. Schubert, T. L. Eng, and B. J. Benishek *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 8-9 (See N63-11465 03-16)
OTS: $6.00

The Boeing Company has demonstrated the feasibility of supporting man's respiratory requirements with a photosynthetic algae system and has successfully concluded a 56-hour manned test. Although the system tested required 380 liters of algae culture, tests with thinner tanks have given data indicating that a man can be supported on a much smaller volume. Author

N63-11468 Electric Boat Div., General Dynamics Corp., Groton, Conn.

DESIGN AND DEVELOPMENT OF AN ENGINEERING MODEL PHOTOSYNTHETIC GAS EXCHANGER

H. Wallman and J. Dodson *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 20-41 (See N63-11465 03-16)
OTS: $6.00
(Contract AF 33(616)-7840)

A photosynthetic gas exchange system instrumented to provide for continuous recording of oxygen and carbon dioxide analyses, algae density and temperature was designed, fabricated, and tested. The system consisted of three major components: a multipass light chamber, a countercurrent gas contacting tower, and an instrument console. In addition, a centrifuge was provided for the harvesting of algae. Based on the growth rate of algae, the unit utilized up to 0.90 SCFH of carbon dioxide and produced up to 1.09 SCFH of oxygen. Author

N63-11469 Martin-Marietta Corp., Denver, Colo.

SOLAR ILLUMINATED PHOTOSYNTHETIC GAS EXCHANGER

Robert D. Gafford and John D. Fulton (USAF Arctic Aeromedical Lab.) *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 42-63 13 refs (See N63-11465 03-16) OTS: $6.00

(Contract AF 41(657)-389)

The growth and photosynthesis in two different configurations of solar illuminated systems—the hemispherical dome and the flat panel—are studied. Under the conditions of the study, it was observed that the solar-oriented panels were more effective than the domes. No apparent changes in the *Chlorella* were observed, but the *Synechococcus* did change from its normal blue-green color to a more olive-green shade. Apparently the continuous exposure to surface levels of infrared radiation was not harmful to either species. The ability of both species to grow well and produce oxygen at high rates in direct solar light in thin films at reasonably low densities is the important observation of these studies. J.R.C.

N63-11470 Aerojet-General Corp., Azusa, Calif.

HIGHLY CONCENTRATED CARBON DIOXIDE AS A CARBON SOURCE FOR CONTINUOUS ALGAE CULTURES

R. W. Tew, J. O. Sane, and R. P. Geckler *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 64-80 10 refs (See N63-11465 03-16) OTS: $6.00

The results of the experiments reported here establish the feasibility of using highly concentrated carbon dioxide for continuous algae growth. This has been demonstrated in a continuous culture of *Chlorella* Tx 71105 in which algae growth rates were balanced against carbon dioxide addition rates, and in which potassium nitrate served as the nitrogen source. Author

N63-11471 RIAS, Baltimore, Md.

LIGHT CONVERSION IN PHOTOSYNTHESIS

Bessel Kok *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 83-104 16 refs (See N63-11465 03-16) OTS: $6.00

(Contracts AF 49(638)-947 and AF 41(609)-1550; NIH Grant RG-6692)

This paper on light conversion in photosynthesis covers the following: metabolic energy units, chloroplast reactions, absorption and fluorescence, the photosynthetic unit, photocatalyst P700, evidence for two photoreactions in photosynthesis, the first and second photoreaction, and the distribution of light between the two photo steps. J.R.C.

N63-11472 RIAS, Baltimore, Md.

STRUCTURE OF THE PHOTOCHEMICAL APPARATUS IN PHOTOSYNTHESIS

George Schidlovsky *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 105-130 17 refs (See N63-11465 03-16) OTS: $6.00

(Contract AF 49(638)-947; NIH Grant -C-3370)

Chlorophyll-bearing cells have been studied with the electron microscope to determine the structure of their photochemical apparatus. Slides were prepared of the following plants: algae TX-27, *Chlorella vulgaris*, *Euglena gracilis*, and spinach. The lamella structures in the chloroplasts of these cells were measured and found to be approximately 150 to 160 Å thick when fixed with potassium permanganate and 160 Å thick when fixed with osmium tetroxide. R.C.M.

N63-11473 Kettering Lab., U. of Cincinnati, Ohio

MECHANISM OF OXYGEN EVOLUTION IN PHOTOSYNTHESIS

Leo P. Vernon *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 131-198 182 refs (See N63-11465 03-16) OTS: $6.00

The evolution of oxygen by green plant cells during photosynthesis is discussed in terms of its being a result of water serving as the electron donor for a photochemically generated oxidation site, Y. Transfer of an electron from water to Y would produce YOH, which, through a light-independent enzymatic reaction, produces oxygen. The nature of Y and the subsequent enzymatic steps are not known, although a number of inhibitors of photosynthesis have been shown to be active because of their ability to inhibit the oxygen evolution step. There appears to be no common chemical feature among the various compounds, although a number of the compounds are substituted amines. Author

N63-11474 Kettering Lab., U. of Cincinnati, Ohio

REQUIREMENTS AND FUNCTIONS OF MICRONUTRIENTS BY GREEN PLANTS WITH RESPECT TO PHOTOSYNTHESIS

Clyde Eyster *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 199-209 28 refs (See N63-11465 03-16) OTS: $6.00

Presently only five trace elements seem to be directly concerned with photosynthesis of green plants. Manganese and chlorine each have a role in oxygen evolution. Vanadium accelerates photosynthesis under high light intensity but as yet this effect has been reported only for *Scenedesmus obliquus* and *Chlorella*. Iron is the metal part of cytochromes which enter into electron transfer, and is the metal constituent of photosynthetic pyridine nucleotide reductase, a water soluble enzyme required for TPN reduction. Although more zinc is required in light-grown than in dark-grown cultures of *Chlorella*, its role in photosynthesis is uncertain. One might suspect zinc to aid in hydrogen transfer since zinc is definitely known to be the metal constituent of various dehydrogenases. Author

N63-11475 Boeing Co., Seattle, Wash.

INVESTIGATIONS OF SELECTED HIGHER PLANTS AS GAS EXCHANGE MECHANISMS FOR CLOSED ECOLOGICAL SYSTEMS

In Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 213-232 7 refs (See N63-11465 03-16) OTS: $6.00

(Contract AF 33(616)-7945)

Studies were made of food plants to determine their potential application to closed ecological systems for spacecraft. Food plants

were selected from the angiosperms (seed plants) and include: lettuce, chinese cabbage, turnip, tampala, endive, radish, and sweet potato. These plants were evaluated by measuring photosynthetic activity under controlled conditions of temperature, humidity, and light. From this preliminary evaluation, chinese cabbage, endive, and tampala were selected for detailed studies of photosynthetic activity, water utilization, ease of reproduction, resistance to disease, and response to varying conditions of light, temperature, humidity, and atmospheric composition. A detailed chemical analysis of these plants was made and their nutrient value established by animal feeding. The data indicate that these three plants may provide a valuable nutritional supplement for the spacecraft crew in the closed ecological system. R.C.M.

N63-11476 North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.

THE PERMANENT LUNAR BASE: DETERMINATION OF BIOLOGICAL PROBLEM AREAS

J. C. Finn, Jr., and O. D. R. Brown *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 233-241 4 refs (See N63-11465 03-16) OTS: $6.00

A discussion of potential biological problems in connection with a permanent lunar base covers the following: pure algae subsystems, algae-bacteria subsystem, algae-bacteria/food animal subsystem, and the complete subsystem. J.R.C.

N63-11477 Republic Aviation Corp. Space Environment and Life Sciences Lab., Farmingdale, N.Y.

EFFECT OF ATMOSPHERIC PRESSURE, GRAVITY, AND PARTIAL PRESSURE OF NITROGEN ON PLANT GROWTH

F. B. Benjamin, W. I. Taufman, and W. M. Helvey *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 242-264 (See N63-11465 03-16) OTS: $6.00

A study is conducted to ascertain the effect of atmospheric pressure, gravity, and partial pressure of nitrogen on plant growth. The Bel Jar technique was used to obtain germination and growth data on beets, beans, turnips, and carrots for different ambient pressures. Five different plants were rotated continuously over periods from two to six weeks to simulate growth under zero "G". Germination development is apparently no different in controlled and simulated zero and lunar gravity; however, the number of experiments is too small to determine the effect on percent of germination. It is shown that the partial pressure of nitrogen has an inverse relationship to plant growth and total water, and a direct relationship to percentage of water. It was found that rhythmic changes of metabolic activity were observed which appear to be independent of diurnal rhythm, light, and temperature. J.R.C.

N63-11478 Aerospace Medical Center. School of Aerospace Medicine, Brooks AFB, Texas

PRELIMINARY REPORT ON THE PHOTOSYNTHETIC GAS EXCHANGE POTENTIALITIES OF THE FAMILY LEMNACEAE (DUCKWEED)

S. S. Wilks *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 265-278 10 refs (See N63-11465 03-16) OTS: $6.00

A study is made of the photosynthetic gas exchange potentialities of the family *lemnaceae* (duckweed). It was found that the gaseous exchange rates of *Wolffia* and *Spirodela* are almost identical, whereas, *Lemna* is somewhat lower. Of the three types of duckweed grown, the greatest degree of success is with the culture *Spirodela*. Using a controlled temperature, a gas exchange rate of 19.2 liters/day was obtained. J.R.C.

N63-11479 Aerospace Medical Center. School of Aerospace Medicine, Brooks AFB, Ohio

AEROBIC WASTE DISPOSAL SYSTEMS

James E. Moyer *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 281-289 6 refs (See N63-11465 03-16) OTS: $6.00

Man's exploration of space for extended time periods will necessitate the development of processing procedures for the recycling of accumulating wastes into edible forms. The advantages and disadvantages of utilizing an activated sludge process for the partial conversion of the wastes into useful byproducts are considered. One of the major objections to the use of a system of this nature is the large volumes of O_2 required for complete oxidation of the wastes. This requirement would impose a drain on the oxygen reserves of the closed ecology. A microbiological waste-disposal system, capable of satisfying its own oxygen demand from the evolved CO_2, would alleviate the depletion of oxygen reserves and offer the additional advantages of being completely separated from other components of the closed ecology. A system designed to accomplish this objective was devised by the addition of selected sewage algal strains to activated sludge cultures. Author

N63-11480 Martin-Marietta Corp. Life Sciences Section, Denver, Colo.

WASTE CONVERSION BY ANAEROBIC THERMOPHILIC METHODS

Hugh L. Pote *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 290-294 (See N63-11465 03-16) OTS: $6.00

The efficiency of an anaerobic thermophilic biological waste digester has been shown to be significant enough to warrant further experimentation. A number of engineering problems still remain to be solved so that this segment of the regenerative system will require less attention. The possibilities of producing an innocuous nitrient solution for plant growth are quite promising, and further efforts in this direction are definitely indicated. Author

N63-11481 Whirlpool Corp. Life Support Dept., Evansville, Ind.

GAS PRODUCTION BY STORED HUMAN WASTES IN A SIMULATED MANNED SPACECRAFT SYSTEM

Robert B. Wheaton, John J. Symons, Norman G. Roth, and Harold H. Morris *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 295-314 7 refs (See N63-11465 03-16) OTS: $6.00

An investigation on gas production by stored human wastes in a simulated manned spacecraft system showed the following results: (1) Untreated fecal material stored in sealed containers at 30° C produced an appreciable gas pressure within the containers. The rate of pressure increase varied inversely with time. The pressure increased most rapidly during the first 4 days of storage. (2) Most fecal samples produced from 3.5 to 6 mls. of gas (at STP) per gram of feces. There was a tendency for smaller (lighter weight) stools to produce more gas per gram of feces. (3) The volume of gas produced per weight unit plotted as a function of time followed a logarithmic curve during at least part of the 14-day storage period. The slopes of these plots

varied from sample to sample. (4) The pressure produced by any sample was very dependent on the headspace of the container. When headspace became less than the volume of feces, excessively high pressures were reached. (5) The major gases produced under these conditions by sealed individual stools were carbon dioxide, methane, hydrogen and hydrogen sulfide. Most of this gas was produced in the first 4 days of storage. (6) Two types of fecal samples were observed in this investigation. Type A samples were carbon dioxide producers and slow oxygen utilizers. Type B samples were carbon dioxide and methane producers and rapid oxygen utilizers. Certain individuals always produced either type A or B stool samples, but so far no one has been observed to produce both. Author

N63-11482 Northwestern Technological Inst., Evanston, Ill.

GROWTH OF *CHLORELLA* ON PRODUCTS FROM THE INCINERATION OF HUMAN WASTES

Wesley O. Pipes and J. E. Quon *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 315-327 5 refs (See N63-11465 03-16) OTS: $6.00

This report covers the studies of the first stage of the incineration process, i.e., determination of the time and temperature requirements for the complete volatilization of the organic matter of human wastes and the investigation of the properties of the residual ash as a nutrient for algae. Data from experiments conducted indicated that a volatilization temperature of 300° C to 350° C is suitable for minimizing peak carbon loads on the combustion chamber. This temperature should be maintained for forty to sixty minutes and then raised to 600°C for ten minutes. This latter phase of operation enables 99.8% of the carbon to be utilized. Algal growth experiments, using *Chlorella pyrenoidosa*, demonstrated that ash will provide all required nutrients except for carbon, water, and nitrogen. If the combustion stage of the incineration process can be made to operate efficiently, there should be no problem in recovering carbon dioxide and water from the effluent gas. It appears that the major problem with the incineration of human wastes to produce nutrients for algal growth is the recovery of nitrogen, since it is, for the most part, probably in the gaseous state. I.v.L.

N63-11483 Electric Boat Div., General Dynamics Corp., Groton, Conn.

ANIMAL NUTRITION STUDIES WITH *CHLORELLA* 71105. PART I: PROTEIN QUALITY, DIGESTIBILITY, AND COMPOSITION

Joseph A. Lubitz *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 331-356 17 refs (See N63-11465 03-16) OTS: $6.00

Contract AF 33(616)-7373)

Studies have been made with algae to determine their nutritional characteristics for potential application as space food. The strain of *Chlorella* 71105 was analyzed for vitamins, minerals, and amino acids, and feeding studies were carried out with rats. The analysis shows that the 606 grams of dried *Chlorella* produced daily by a one-man gas-exchange system would furnish 100 times the daily allowance of Vitamin A as carotene, four times the protein allowance, about the daily requirement of ascorbic acid and calcium, three times the daily requirement of thiamine, and six times the daily requirement of iron. The feeding studies show that rats can grow, with slight growth-retarding effects, on rations utilizing 92% *Chlorella*. With 21% *Chlorella* as the sole source of protein, the rats showed satisfactory growth. R.C.M.

N63-11484 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

NUTRITIONAL VALUE OF ALGAE GROWN UNDER STERILE CONDITIONS

John E. Vanderveen, Eugene G. Sander, Charles M. Cox, and Kenneth M. Offner *In its* Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 357-364 5 refs (See N63-11465 03-16) OTS: $6.00

Data are presented on the digestibility of protein and energy in diets containing sterile heterotrophic, sterile autotrophic, and contaminated autotrophic algae. These data show that the digestibility of protein and energy of sterile algae was higher than that of contaminated algae. The digestibility of both protein and energy of sterile heterotrophically grown algae was higher than that of the sterile autotrophically grown algae. These differences would disqualify the use and application of data obtained from heterotrophically grown algae to autotrophically grown algae. The differences noted in the digestibility of protein and energy between sterile and contaminated algae warrant further study. Author

N63-11485 Ohio State U., Columbus

FUNGI AS A NUTRIENT SOURCE

William D. Gray *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 365-380 2 refs (See N63-11465 03-16) OTS: $6.00

The problem of a rapidly increasing world population is briefly discussed, and the thesis that a general food shortage is imminent is denied. Instead, it is pointed out that with increasing population the world faces shortage of one food type: protein. Two possible solutions to the problem have been suggested: (1) an extraction and concentration of protein from materials in which it is quite dilute, and (2) the fungal synthesis of protein from excess carbohydrates and inorganic salts of nitrogen. The fungal synthesis of protein is briefly discussed and the high potential of such a process is pointed out. The recommendation is made that in the United States, such material be used as a protein supplement for livestock feeding, in order that greater amounts of meat protein may be produced to keep pace with increasing population. Author

N63-11486 Republic Aviation Corp., Farmingdale, N.Y.

BIO-ECOLOGY OF DIGESTION

L. S. Gall, D. B. Tenzer, and W. M. Helvey *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 382-390 28 refs (See N63-11465 03-16) OTS: $6.00

A consideration of the bio-ecology of digestion demonstrated the importance of: (1) the role of microorganisms in the digestive tract in digestion, (2) the influence of the host on the microorganisms in the digestive tract, and (3) the influence of these microorganisms on the host. Author

N63-11487 Armour Research Foundation, Chicago, Ill.

ENZYMATIC DIGESTION OF ALGAL CELLS

Alan M. Shefner, Maurice E. King, and Bernice Kohn *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 391-404 24 refs Previously issued as ARF 3193-5; for abstract see N63-10151 01-16

(Contract AF 33(616)-7964)

It is evident that the algal cell wall is a highly complex structure. Not only does it contain carbohydrate residues other than glucose, but many of the bonds in the various polysaccharides of which it is partially composed are not susceptible to human digestive carbohydrases. The variety of basic carbohydrate residues which have been recovered from algal material makes it unlikely that a single highly purified enzyme would be able to cause extensive degradation. Two main lines of research, which are in reality dependent upon

each other, appear to offer the greatest likelihood for successfully degrading algal cell walls. The first is a continued study of cell wall polysaccharides, including identification of simple residues and fragments derived through acid and enzymatic degradation of cell wall preparations. The second is a study of cell wall degrading enzymes derived from natural sources in which algae constitute a normal part of their diet. The survey of enzymes of potential usefulness indicated that a number of marine organisms, or the bacteria of their gastrointestinal tract, elaborated a large number of such enzymes. The use of enzyme additives in algal diet for human nutrition does appear to offer a way of obtaining maximal nutritional benefit from the food which is to be consumed. The usefulness of these additives must be demonstrated in whole-animal experiments. Author

N63-11488 Army Medical Research and Nutrition Lab., Denver, Colo.

NUTRIENT CONTENT OF VARIOUS ALGAE AND AMINO ACID ADEQUACY FOR GROWTH OF RATS AND CHICKS

G. A. Leveille, H. E. Sauberlich, and M. E. Mc Dowell *In* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Biologistics for Space Systems Symposium, Dayton, Ohio, May 1-3, 1962 [Final Report] Oct. 1962 p 405-419 12 refs (See N63-11465 03-16) OTS: $6.00

Analytical data are presented demonstrating a high nutritive potential for algae. Data are presented on the content of protein, amino acids, certain vitamins, lipid, ash, and calories in various algae. The protein analyses demonstrate that only 80% of the nitrogen of algae is amino nitrogen. Studies on the protein quality and amino acid deficiences of three algae samples for growing rats and chicks are reported. Chicks or rats fed diets in which the protein was supplied by 1) a mixture of *Scenedesmus obliquus* and *Chlorella ellipsoida*, or 2) *Chlorella pyrenoidosa*, or 3) *Spongiococcum excentricum* grew less well and had lower protein efficiency ratios than their respective controls receiving soybean-oil meal or casein protein. Amino acid supplementation studies showed all the algae fed to be deficient in methionine. In addition, the mixed algae was deficient in glycine for the chick and the algae *C. pyrenoidosa* was deficient in histidine for the growing rat. Data are presented which indicate that the amino acids of the mixture of algae (*S. obliquus* and *C. ellipsoida*) may be imbalanced for the growing chick. Author

N63-11508 National Aeronautics and Space Administration, Washington, D.C.

BIOASTRONAUTICS

George B. Smith, Jr., Siegfried J. Gerathewohl, Bo E. Gernandt, Richard S. Johnston, and Richard S. Young 1962 36 p 60 refs Papers presented at Session L of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29)
(NASA-SP-18) GPO:

CONTENTS:

1. ENVIRONMENTAL BIOLOGY G. B. Smith, Jr. (NASA. Manned Spacecraft Center) 4 p
2. PHYSIOLOGICAL AND BEHAVIORAL SCIENCES S. J. Gerathewohl and B. E. Gernandt (NASA. Ames Research Center) 15 p 43 refs
3. BIOENGINEERING Richard S. Johnston (NASA. Manned Spacecraft Center) 8 p 1 ref
4. EXOBIOLOGY Richard S. Young (NASA. Ames Research Center) 7 p 16 refs

N63-11535 Oak Ridge National Lab., Tenn.

RADIATION SAFETY AND CONTROL MANUAL

F. R. Bruce AEC Div. of Tech. Information, Dec. 1962 110 p (TID-7027) OTS: $2.50

This manual is provided as a convenient source of information concerning Radiation Safety and Control. Laboratory policy requires that all operations must be performed in such a manner as to minimize personnel exposures, property losses from contamination, and environmental contamination. Author

N63-11540 Argonne National Lab., Ill.

GROWTH AND DEVELOPMENT OF PLANTS IN COMPENSATED GRAVITATIONAL, MAGNETIC, AND ELECTRICAL FIELDS Interim Report

Solon A. Gordon and Jane Shen Miller May 14, 1962 14 p
(NASA Order R-46)
OTS: $1.60 ph, $0.80 mf

Work so far has concentrated chiefly on the construction of suitable apparatus. A 2 π compensator has been completed. It is now being used in preliminary experiments with differentiated plant organs. A 4 π compensator is still under development. Author

N63-11542 Joint Publications Research Service, Washington, D. C.

AN AUTOMATIC PROGRAMMING DEVICE FOR INVESTIGATING MOTOR DEFENSIVE CONDITIONED REFLEXES

D. M. Belov, S. S. Krylov, and Ye. A. Snegirev Jan. 7, 1963 13 p 5 refs Transl. from Zhur. Vysshei Nervnoi Deyatel'nosti im. I. P. Pavlova (Moscow), v. 12, no. 5, 1962 p 969-974
(JPRS-16994) OTS: $1.60

An instrument is described for the transmission of signals in the study of defensive-conditioned reflexes in small animals. The device performs the following automatic functions: activates stimuli in any sequence, cuts off conditioned stimulus upon the animal's fulfillment of the objective, transmits unconditioned stimuli to that section of the test chamber where the animal has been acted upon by conditioned stimuli, and records the time of stimulus action and the animal's motor reactions with a minimum expenditure of movie film. R.C.M.

N63-11543 Joint Publications Research Service, Washington, D.C.

PROTECTION AGAINST RADIATION

Ye. Romantsev Jan. 7, 1963 33 p 14 refs Transl. from Bol'shaya Meditsinskaya Entsiklopediya (Moscow), v. 26, 1962 p 1150-1168
(JPRS-16995) OTS: $3.60

Methods are presented for protecting personnel from radiation hazards. The biological effects of radiation depend on the dose absorbed and on the relative biological effectiveness (RBE) of different kinds of radiation. On the basis of experimentally obtained RBE, the *Sanitary Regulations* issued by the USSR Ministry of Health presents tables of maximum permissible dose (MPD) rates. This data can be used to determine the limits of danger under various exposure conditions. Personnel can be protected against MPD by controlling the radiation level, by the use of shields, by remote handling, and by limiting exposure time. Examples of these methods are discussed and recent advances in chemical protections are reviewed. R.C.M.

17 MACHINE ELEMENTS AND PROCESSES

Includes: bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; and materials fabrication, handling, and inspection.

For related information see: 06 Auxiliary Systems.

N63-11011 Northrop Corp. Norair Div., Hawthorne, Calif.

QUARTZ LAMP RADIANT HEAT BRAZING OF LARGE REFRACTORY METAL HONEYCOMB SANDWICH PANELS Interim Engineering Progress Report, 10 July 1962-10 October 1962

D. B. Hugill and B. Gaiennie' Wright-Patterson AFB, Ohio, Manufacturing Tech. Lab. [1962] 65 p 28 refs
(Contract AF 33(657)-9810)
(IR-7-937a(I))

This project is planned to develop manufacturing methods and design criteria for refractory metal brazed sandwich structures of sufficient size to be practical for aerospace vehicles. The quartz lamp radiant heating system will be used. Investigation has demonstrated that diffusion bonded honeycomb core can be produced and that successful brazing can be accomplished under time, temperature, and inert gas atmosphere conditions representative of the quartz lamp radiant brazing system. Author

N63-11042 Alloyd Electronics Corp., Cambridge, Mass.
DEVELOPMENT OF NON-VACUUM ELECTRON BEAM WELDING Interim Technical Engineering Report, 15 October 1961-15 February 1962
L. H. Leonard, J. R. Morley, and L. Dunn Wright-Patterson, AFB, Ohio, Manufacturing Tech. Lab., Feb. 1962 120 p 20 refs
(Contract AF 33(657)-7237)
(AFSC-TR-7-926(I))

Electron beam welding of aerospace metal in a nonvacuum environment is feasible if the electron beam has sufficient initial power density that, after being degraded by scattering, the residual power density is adequate to acomplish joining. This report suggests criteria and establishes system parameters to accomplish such welding. The minimum power-density required for the joining is approximately 0.5 megawatt per square centimeter. Higher power densities, several megawatts per square centimeter, are necessary if deep narrow welds are to be obtained. To obtain these power densities in the nonvacuum environment, the beam, brought out from a region of high vacuum through a series of three differentially pumped apertures, must have an initial power density slightly in excess of 0.5 Mw/cm^2 when using helium gas as the controlled environment. For the other gases considered, nitrogen and argon, the requisite initial power density is 2 to 7 times higher. Author

N63-11045 SKF Industries, Inc. Research Lab., Philadelphia, Pa.
INFLUENCE OF LUBRICATION ON ENDURANCE OF ROLLING CONTACTS. SPECIAL REPORT ON X-RAYS PASSING BETWEEN TWO IDENTICAL SPHERES
Ronald L. Huston Nov. 9, 1962 97 p
(Contract NOw-61-0716-C)
(AL62L020)

A mathematical investigation of the radiant X-ray energy passing between metallic spheres is presented with the primary emphasis placed upon configurations of significant practical interest. The analysis is essentially divided between two parts which pertain to the direct and reflected radiation; and results are obtained which relate to each part as well as the total, combined radiation. The results provide a relationship between the radiant X-ray energy and the separation between the metallic spheres. Graphical and tabular results are given for a specific geometric configuration. Geometric and algebraic approximations are used in order to simplify the analysis. Also, physical assumptions are made regarding X-ray reflection. A complete account of the approximations is maintained, and an estimate of the error is available for all expressions throughout the analysis. Author

N63-11278 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANICAL ELEMENTS FOR VACUUM OPERATION
Harold E. Evans, Thomas W. Flately and M. Francis Federline N. Y., Am. Rocket Soc. [1962] 12 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2711-62) ARS: $0.50 members, $1.00 nonmembers

Included are the first two phases of a program investigating the high-speed operation of miniature ball bearings with metallic film lubrication and the first phase of an investigation for determining the "best bet" gear material combinations and methods of lubrication. Results of the bearing study indicate that both gold and silver appear promising as lubricants for vacuum operation and that the bearings exhibit: (1) an early dip in speed or initial erratic performance, which indicates that a "run-in" period is required; (2) a sudden failure, rather than a gradual decrease in speed, which makes the prediction of impending failure difficult. A stainless-steel (303) gear operating with a Delrin gear at a pitch line velocity of 942 fpm has operated for over 175 hours, without failure, in a vacuum of 10^{-7} torr; and a stainless-steel gear operating with an aluminum gear at a pitch line velocity of .8 fpm has operated for over 700 hours, without failure, in a vacuum of 6×10^{-9} torr. Author

N63-11305 Japan. Ministry of Transportation. Transportation Technical Research Inst., Tokyo
DESIGN DIAGRAMS OF MODERN FOUR, FIVE, SIX AND SEVEN-BLADED PROPELLERS DEVELOPED IN JAPAN
Atsuo Yazaki Tokyo, The Unyu-Gijutsu Kenkyujo Mejiro, Toshima-Ku, Sept. 1962 18 p 7 refs
(TTRI-52)

Design diagrams have been published in Japan for the three- and four-bladed propellers with the Unken-type aerofoil blade section and have been widely used for design purposes. With the ever-increasing speed and power of modern ships, however, it has been desired to develop modern propellers having higher performance not only in efficiency but also in cavitation and vibration characteristics. To meet this requirement, the author has successfully developed many types of propellers with AU-type aerofoil blade sections (hereinafter called AU-type propellers) improved from the Unken-type aerofoil by using the results of preliminary tank tests and cavitation tests employing many model propellers. The systematic testing with AU-type propellers has so far been conducted for four-, five-, six-, and seven-bladed propellers, and many kinds of design diagrams based on these tests have been made and used for actual designs. Author

N63-11342 Cook Electric Co. Inland Testing Labs., Dayton, Ohio
IMPROVEMENT OF NICKEL-CADMIUM BATTERIES Monthly Technical Progress Report 16, 20 July 1962 to 20 Aug. 1962
I. F. Luke Aug. 22, 1962 14 p
(Contract NAS5-1048)
OTS: $1.60 ph, $0.80 mf

The object of this study was to improve nickel-cadmium batteries through testing and analysis of failures. Vibration and acceleration tests were completed on samples of the Gulton VO-6HS cells with no evidence of failures. Capacity measurements were completed on all the Gulton cells. Optimum capacity tests were completed on the Sonotone and the Gould-National cells. Data on the capacity measurements of the cells of each manufacturer and the optimum capacity of the Sonotone and Gould-National are presented. I.v.L.

N63-11442 Alloyd Electronics Corp., Cambridge, Mass.
A STUDY OF ELECTRON-BEAM WELDING Second Quarterly Report
S. S. White and R. Bakish Watertown Arsenal Labs., Feb. 1962 104 p 10 refs
(Contract DA-19-020-ORD-5484)
(WAL-401.54/2-2)

Techniques have been developed for the utilization of the electron beam as a practical tool for postheating of weldments in material of any initial hardness or condition of heat treatment. Ultimate strengths of electron-beam weldments in solutionized and rolled titanium-alloy sheet were obtained in fusion and heat-affected zones by this technique. Strengths of the 180,000 psi ultimate strength level have been produced. Impact resistances remain high, and incremental strains may be increased. Aged titanium alloys show

impact resistance and strain increases. Moduli of elasticity in base metal and fusion zones may be matched for titanium alloys in any condition of heat treatment or hardness prior to welding. Author

18 MATERIALS, METALLIC

Includes: cermets; mechanical and physical properties of alloys and metals; and metallurgy.

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Non-metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-11027 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.

ZIRCONIUM: CHEMICAL AND PHYSICAL METHODS OF ANALYSIS

Samuel Vladimirovich Elinson and Karl Ivanovich Petrov Nov. 1962 235 p 395 refs Transl. by Helen Basil (Argonne National Lab.) of "Tsirkoniy: Khimicheskie i Fizicheskie Metody Analiza" Moscow, Main Admin. on the Use of Atomic Energy at the Council of Ministers, 1960

(AEC-TR-5373) OTS: $3.00

This monograph on zirconium covers the following: general physical and chemical properties; chemical properties of zirconium aqueous solutions; analytical characteristic of zirconium; application of solubility methods to substances containing zirconium; separation of zirconium from other elements and gravimetric methods for its determination; volumetric, photometric, and radiometric methods and optical spectra and X-ray spectrum methods of zirconium determination; determination of impurities in zirconium and alloys with a zirconium base by chemical methods; determination of zirconium impurities by physical methods; and determination of gases in zirconium. J.R.C.

N63-11044 Los Alamos Scientific Lab., N. Mex.

SOME OBSERVATIONS OF THE EFFECT OF ATMOSPHERIC HUMIDITY ON THE FLOW OF METAL POWDER

H. D. Lewis, T. J. Ready, and H. H. Hausner Nov. 14, 1962 24 p 9 refs

(Contract W-7405-eng-36)

(LAMS-2773)

The general investigation of process variables affecting the precision powder-rolling of refractory fuel elements led to some semiquantitative observations of the effect of atmospheric humidity on certain aspects of the powder-rolling process. This report summarizes the observations of the effects of the powder's atmospheric environment on the powder-flow characteristics and indicates the requirement that the powder's atmospheric environment be controlled in all phases of the rolling process. Author

N63-11053 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

TENSILE PROPERTIES OF FIVE LOW-ALLOY AND STAINLESS STEELS UNDER HIGH-HEATING-RATE AND CONSTANT-TEMPERATURE CONDITIONS

W. W. Gerberich, H. E. Martens, and R. A. Boundy June 1, 1962 49 p 10 refs

(NASA Contract NAS7-100)

(JPL-TR-32-222) OTS: $4.60 ph, $1.67 mf

The purpose of this investigation was to fill several gaps in the literature on high-heating-rate properties of several commonly used aerospace, structural materials. High-heating-rate results were obtained for three low-alloy steels: 4340 (400° F temper), 4130 (800° F temper), and 4130 (1050° F temper) and two stainless steels: 17-7 PH (TH 1050) and 410 (700° F temper). Stress levels ranging from 10 to 125 ksi and heating rates varying from 40 to 2000° F/sec. were the testing parameters. A method is devised to compare yield temperature data of high-heating-rate tests to tensile yield data of steady-state elevated temperature tests. Results indicate that high-heating-rate properties of all the materials are superior to steady-state elevated temperature properties for heating rates of 40° to 2000° F/sec. For the low-alloy steels, the higher the tempering temperature, the better the high-heating-rate properties. Properties of 410 stainless steel are superior to those of all other materials investigated. Author

N63-11055 Los Alamos Scientific Lab., N. Mex.

BIBLIOGRAPHY ON CORROSION BY LIQUID METALS (1957—SEPTEMBER 1962)

Helen J. Chick, comp. Nov. 23, 1962 39 p 170 refs

(Contract W-7405-eng-36)

(LAMS-2779) OTS: $1.00

N63-11176 Timken Roller Bearing Co. Steel and Tube Div., Canton, Ohio

RESUMÉ OF INVESTIGATIONS ON STEELS FOR HIGH-TEMPERATURE, HIGH-PRESSURE APPLICATIONS, 1960—1962

[1962] 140 p 11 refs

This resumé of investigations on steels for high-temperature and high-pressure applications covers the following: high-temperature properties of production heats of type TP321H tubing; high-temperature properties of production heats of TP304H tubing; effect of carbon and manganese content on the rupture strength of Type 304; high-temperature properties of production heats of DM tubing, 2-1/4Cr-1 Mo tubing; comparative high-temperature properties of large-diameter heavy-wall tubing of types TP304H, TP316H and TP347H; properties of severely cold-worked austenitic alloys; properties of high-strength low-alloy steels at slightly elevated temperatures; specifications; and preliminary properties of TP316 plus columbium. J.R.C.

N63-11207 Joint Publications Research Service, Washington, D.C.

ARTICLES ON SOVIET CERAMICS AND REFRACTORIES

S. M. Zubkov et al Dec. 21, 1962 42 p 23 refs Transl. of six articles from Ogneupory (Moscow), no. 10, 1962 p 449-453, 457-472, and 480-481

(JPRS-16807) OTS: $4.60

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1. STRUCTURE AND PROPERTIES OF CHROMITE ORES FROM NEW DEPOSITS IN KAZAKHSTAN S. M. Zubkov and E. N. Yusupova (Inst. of Met. and Beneficiation of the Acad. of Sci. Kazakh SSR) p 1-9 6 refs
2. CERTAIN PROPERTIES OF A POROUS CERAMIC MADE OF BERYLLIUM OXIDE I. Ya. Guzman and D. N. Poluboyarinov (Chemico-Technol. Inst. im. Mendeleyev) p 10-19 6 refs
3. PHASE COMPOSITION OF CARBORUNDUM REFRACTORIES WITH A SILICON NITRIDE BINDER N. I. Voronin and N. I. Krasotkina (All-Union Inst. of Refractories) p 20-28 2 refs
4. PROPERTIES OF CERTAIN PROTECTIVE COATINGS DEPOSITED ON METAL BY THE GAS-FLAME SPRAY METHOD Yu. A. Pirogov (Ukrain. Sci. Res. Inst. of Chem. Machinery) p 29-35 9 refs
5. CONFERENCE ON THE COORDINATION OF RESEARCH WORK ON NONMETALLIC ELECTRIC HEATING ELEMENTS N. I. Voronin (All-Union Inst. of Refractories) p 36-37
6. CONFERENCE ON LIGHTWEIGHT REFRACTORIES A. K. Karklit (All-Union Inst. of Refractories) and Z. Ye. Dobrin (Borovich Refractories Combine) p 38-39

N63-11211 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio

HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 18, Part A [Sept. 15-Nov. 15, 1962]

Dec. 14, 1962 36 p 15 refs
(Contract AT(40-1)-2847)
(GEMP-18A) OTS: $1.00

Studies to define the preirradiation properties continued, and additional data were obtained on elastic constants, strength, thermal stability, and compressive creep. Irradiation tests continued on schedule, and additional data were obtained on lattice parameters, dimensional and volume expansion, strength, and creep of irradiated specimens. Nonradiation results include a summary of the elastic constant data in terms of the influence of porosity, preferential orientation, and temperature. The moduli of elasticity in the directions normal and parallel to the basal plane were computed from polycrystalline data. Postirradiation measurements indicate that specimens of 5-micron grain size retained about 25 percent of their unirradiated strength in irradiations at 600° C to a dosage of 1.5×10^{21} nvt ($\geq$1 Mev). Comparable reduction in strength occurred in larger grain size materials at as little as one-fifth this dosage. Gas bubbles were observed in a specimen irradiated at 1000° C to 3.4×10^{20} nvt ($\geq$1Mev). Author

N63-11227 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

THE VAPORIZATION AND PHYSICAL PROPERTIES OF CERTAIN REFRACTORIES. PART II. EXPERIMENTAL STUDIES. Appendix A: A High Temperature Knudsen Effusion Sampling System Appendix B: Vaporization of Iridium and Rhodium Appendix C: The Vaporization of Alumina (Al_2O_3) Appendix D: The Vaporization of Several Rare Earth Oxides Appendix E: The Vaporization of the Rare Earth Oxides Appendix F: Continuously Monitored Evaporation [Final Report, June 1, 1960 to May 31, 1961]

A. A. Hasapis, A. J. Melveger, M. B. Panish, L. Reif, and C. L. Rosen
Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Oct. 1962 91 p 39 refs
(Contract AF 33(616)-6840)
(WADD-TR-60-463, Pt. II)

The vapor pressure-temperature relationships for iridium, rhodium, ruthenium, iridium plus carbon, alumina, thoria, and hafnia were studied by simple effusion and mass spectrometric methods. Vapor phase species were identified. The vapor pressure data and derived heats of vaporization and reaction are presented. The vaporization modes of the rare earth sesquioxides were studied mass spectroscopically, and data which demonstrate that the mode of vaporization of these materials is strongly dependent upon the number of electrons in the 4f shell of the rare earth metal is given. Continuously monitored effusion experiments conducted on the Mo-Si system yielded the following heats of dissociation in kcal/gm atom Si at 298°K: Liquid-$MoSi_2$, 117.8; $MoSi_2$-Mo_5Si_3, 121.5; Mo_5Si_3-Mo_3Si, 128.3; Mo_3Si-Mo, 132.9. Continuously monitored experiments on the WSi system yielded the following approximate dissociation pressures in atms. at 1765°K: liquid-WSi_2, 3.5×10^{-4}; WSi_2-W_5Si_3, 2.6×10^{-6}; W_5Si_3-W, 1.7×10^{-6}. The surface tensions of silica and silica plus 1% oxide additives, and zirconium plus uranium have been measured by a sessile drop technique. The viscosities of alumina, zirconium plus uranium, pure silica, silica plus 1% V_2O_5, silica plus 1% CoO, and silica plus 1% Al_2O_3 have been determined. Author

N63-11230 Watertown Arsenal Labs., Mass.

FORMATION AND PROPERTIES OF ALUMINA FIBER

Morton I. Kilman Nov. 1962 29 p 7 refs
(WAL-TR-371/50)

The production of high strength aluminum oxide fiber has been achieved by means of plastic extrusion and solid state sintering of selected alumina powders at elevated temperatures. The processing variables for producing fibers possessing transverse rupture strengths of 100,000 psi are presented. The variation of elastic modulus and transverse rupture strength with temperature for alumina fiber is reported for temperatures up to 1300°C. Author

N63-11231 Watertown Arsenal Labs., Mass.

IMPACT STRENGTH OF ALUMINA FIBER-CERAMIC COMPOSITES

Morton I. Kliman Nov. 1962 12 p 3 refs
(WAL-TR-371/51)

The use of randomly dispersed aluminum oxide fiber to impart increased impact strength to a porcelain body and to a refractory aluminum phosphate-bonded alumina body is reported. The improved impact strength is either retained or increased at elevated testing temperatures. The variation of impact strength with alumina fiber content was determined for the fiber-ceramic body composites. Author

N63-11232 Watertown Arsenal Labs., Mass.

FORMATION OF ALUMINA WHISKERS

Morton I. Kliman Nov. 1962 16 p 2 refs
(WAL-TR-371/52)

The feasibility of forming alumina whiskers of strengths approaching that of atomic cohesion has been explored. Some considerations regarding the selection of aluminum oxide as a candidate structural material for whisker production are presented. Aluminum oxide whiskers possessing elastic moduli and transverse rupture strengths greater than those of bulk alumina have been formed by a vaporization-condensation process at temperatures above 1950° C. Typical values for alumina whisker elastic moduli range from 68 to 72 million psi; and transverse rupture strengths average 2,000,000 psi. Author

N63-11233 Watertown Arsenal Labs., Mass.

TRANSVERSE RUPTURE STRENGTH OF ALUMINA FIBER-CERAMIC COMPOSITES

Morton I. Kliman Nov. 1962 16 p
(WAL-TR-371/53)

The utilization of high-strength alumina fiber to reinforce a wide range of ceramic bodies is reported. The transverse rupture strength of these composite structures is markedly increased over that of the bodies without alumina fiber content. The variation of strength increase with alumina fiber content is reported for composites of alumina fiber combined with portland cement, an unfired porcelain body, glass, a porcelain body, and phosphate-bonded alumina. Author

N63-11282 Alfred U. New York State Coll. of Ceramics

ELASTIC PROPERTIES OF SINGLE CRYSTAL MAGNESIA Fourth [Technical] Report

W. B. Crandall, Richard W. Petticrew and D. H. Chung Nov. 1, 1962 32 p 29 refs
(Grant DA-ORD-31-124-60-G58)
(AROD-2891-4)

The elastic moduli in shear and in tension of single crystal MgO were measured on three orientations using a Förester-Type apparatus. Using elastic constants and coefficients which were calculated from these data, values for sound velocity, Debye temperature, compressibility and Voigt-Reuss-Hill intercepts were also calculated. Good agreement was found between the measured polycrystalline elastic moduli determined in the first report and the Voigt-Reuss-Hill values calculated from these single crystal data. Author

N63-11309 Duke U., Durham, N.C.

SPECIFIC HEAT OF ALUMINUM NEAR ITS SUPERCONDUCTIVE TRANSITION POINT Technical Report No. 1

David C. Rorer, Horst Meyer, and Robert C. Richardson Dec. 1, 1962 39 p 28 refs
(ONR Contract 1181(12))

Specific heat measurements are carried out with a high temperature-resolution in different magnetic fields on three specimens of aluminum. The experiments were confined to the region of the critical field curve between 1.1° and 1.2° K and were carried out with a sensitive calorimeter in which temperature changes of $\sim 1.5 \times 10^{-4}$ °K could be determined to about 2%. These measurements gave the difference of the specific heat between the superconductive and the normal state, the latent heat and the critical field curve. For a reversible transition, these three quantities are related by thermodynamic equations and hence it is possible to check their consistency. For one sample, this consistency was within experimental error and we obtained the slope $(dH_c/dT)_{H=0} = -153$ gauss/degree. For the two other samples, there was some disagreement between the critical curve as measured and as calculated. The shape of the transition in zero field has been investigated in detail and it was found that the phase change could take place within about 0.6×10^{-3} °K for one sample, while for the two others it was spread over two millidegrees. From the width, the correlation range was estimated using Pippards theory. The critical temperature in zero field was found to be respectively 1.173°, 1.183°, and 1.188° K, and no λ anomally in the specific heat, as discussed in recent theories, could be detected at the transition. Author

N63-11310 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux

SUR LA STABILITÉ A CHAUD DES ALLIAGES D'ALUMINUM RÉFRACTAIRES DU TYPE AU2GN [ON THE HIGH TEMPERATURE STABILITY OF ALUMINUM REFRACTORY ALLOYS OF THE AU2GN TYPE]

Henry Martinod and Jean Calvet Mar. 1962 23 p 3 refs In French; English summary
(ONERA-TN-67)

Following a detailed study of the effect of silicon on the stability of the AU2GN alloy at temperatures between 150° and 300° C, a contribution is given to the study of the main characteristics of the alloy. The effect of cold-working on the stability of its properties is examined. The mechanical characteristics at high and at room temperatures are compared. Author

N63-11333 Argentina. Comision Nacional de Energia Atomica, Buenos Aires

MICROSCOPIA ELECTRONICA, POR EL METODO DE REPLICAS, DE AL 99.99% RECOCIDO, Y RECOCIDO Y DEFORMADO POR IMPACTO ELECTRONIC MICROSCOPY, DESCRIPTION AND RESULTS OF TESTS ON AL 99.99%: DEFORMATION BY IMPACT AND ANNEALING

P. Kittl and G. Rodriguez 1962 15 p 18 refs In Spanish; English abstract
(*Its* Informe No. 69)

The substructures formed during the cold working of Al 99.99% have been studied. The combined effects of electrolytical polishing and chemical etching have been used to reveal the substructures. A description of the different substructures found in Al deformed by impact are given. They are: substructure of Heidenreich-Hirsch, Perryman, and two other types of substructure with slight deformation. The presence of small grains as well as grain boundary migration have been observed in the slightly deformed region. Author

N63-11336 Bureau of Mines, Washington, D.C.

THERMAL EXPANSION OF MAGNESIUM OXIDE: AN INTERLABORATORY STUDY

William J. Campbell 1962 55 p 36 refs
(BM-RI-6115)

To eliminate the sample variable in measuring expansion, thermal expansion characteristics of a high-purity polycrystalline magnesium oxide were determined by 21 cooperating laboratories using one or more of the following: X-ray camera, X-ray diffractometer, dilatometer, interferometer, and telemicroscope. All expansion values were corrected to a single reference temperature of 25° C. Comparison of results within methods showed the least variance for X-ray camera results; dilatometer and X-ray diffractometer results have about the same variance. The average deviations, in percent, between observed and calculated expansion values among methods were approximately 10 percent from 100° C. to 300° C., 5 percent from 300° C. to 500° C., and 2 percent from 500° C. to 1,400° C. Maximum deviations were approximately twice as large in most instances. Author

N63-11337 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM TSVENTNYYE METALLY (NONFERROUS METALS) [MOSCOW] NO. 11, NOVEMBER 1962

D. I. Layner et al Dec. 1962 27 p Transl. of 4 articles p 80-85, 85-88, 89-92, and 92-95
(JPRS-16855) OTS: $2.60

CONTENTS:

1. INVESTIGATION OF THE DEFORMATION TEXTURE OF ROLLED NIOBIUM D. I. Layner, V. Ya. Selov'yev, Ye. I. Krupnikova-Perlina, and Ye. V. Kachur p 1-8 6 refs
2. VACUUM ROLLING OF CHEMICALLY ACTIVE METALS V. Ya. Ivanov, S. F. Kovtuu, N. D. Tarasov, and R. A. Ul'yanov p 9-13 7 refs
3. WHAT OCCURS IN EXCESS MODIFICATION OF A SILUMIN Ye. A. Boom p 14-19 6 refs
4. THE PREPARATION AND PROPERTIES OF ALUMINIDES OF TITANIUM G. V. Samsonov and V. S. Sinel'nikova p 20-24 6 refs

N63-11338 Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE PROCESS OF SINTERING NIOBIUM POWER

V. M. Amosov Dec. 26, 1962 12 p 8 refs Transl. from Tsvetnye Metal. (Moscow), no. 2, Feb. 1962 p 60-65
(JPRS-16841) OTS: $1.60

The vacuum sintering of niobium powders has been studied to determine the criteria for producing compacts with high ductility. The powder used in the study was produced by cathode precipitation and purified by high-temperature vacuum. The original composition was as follows: Nb, 90.0% (wt); Ta, 2.5%; C, 0.87%; Fe, 0.63%; Ni, 0.27%; Ti, 0.16%; and O_2, 3.2%. The powders were pressed at a specific pressure of 4.3 tons/cm² into bars. Chemical and X-ray analysis were made on the bar after sintering at temperature regimes from 1000 °C to 2350°C. An analysis of the data indicates that the optimum temperature for sintering is 2300 ° C. A bar sintered at this temperature contained 97.3% niobium and was easily rolled into a strip of 0.1 mm thickness. R.C.M.

N63-11417 Union Carbide Corp. Parma Research Lab., Ohio

RESEARCH ON PHYSICAL AND CHEMICAL PRINCIPLES AFFECTING HIGH TEMPERATURE MATERIALS FOR ROCKET NOZZLES Quarterly Progress Report [Oct. 1-Dec. 31, 1962]

Robert Lowrie and R. H. Crist Dec. 31, 1962 65 p refs
(ARPA Order 34-62, Amendment 20; Contract DA 30-069-ORD-2787)

Physical and chemical principles affecting refractory materials for rocket nozzles were investigated. New data obtained on the oxidation of niobium carbide and niobium diboride in slowly flowing carbon dioxide and argon mixtures at 2250° C (brightness temperature) indicated that the carbide and diboride oxidized quite similarly. The products of oxidation of niobium carbide by carbon dioxide have been identified by X-ray diffraction as niobium oxide and niobium dioxide. Refractory carbides and borides corrode less rapidly in hydrogen chloride than in carbon dioxide at 2250° C (brightness temperature). Zirconium metal appeared to be evaporated from zirconium carbide at 2260° C (brightness temperature) after carbon had been removed by reaction with hydrogen. The reaction between zirconium carbide and hydrogen chloride apparently produced zirconium chloride and left carbon on the surface of the sample.

The molecular beam apparatus for conducting gas-solid reactions was successfully tried out. A beam of aluminum atoms was produced and impinged on carbon. Only aluminum atoms were detected in the product beam. Thermal expansion tests and Hall-effect measurements were conducted. Elastic properties of a tungsten rod were determined from pulse-echo measurements of sonic velocities at temperatures up to 1800°C. I.v.L.

N63-11438 Aerojet-General Corp., Azusa, Calif.
INVESTIGATION OF STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS [Sixth Quarterly Progress Report] 1 January through 31 March 1962
R. J. Uzdarwin Apr. 20, 1962 13 p
(Contract DA-04-495-ORD-3069)
(Rept. 0414-01-6)

Extended stress-corrosion testing of selected unwelded bent-beam specimens of 6 high-strength alloys has continued for 33 weeks, and of U-bend specimens for 40 weeks. The alloys of AM355 and PH 15-7 Mo stainless steel and B120VCA titanium were not found to be susceptible to stress-corrosion cracking in any of the environments tested, while the alloy steels of Ladish D6AC, 300M, and Vascojet 1000 were found to have specific susceptibility in some of the environments tested. The evaluation of several coatings for preventing stress-corrosion cracking was initiated, and, on the basis of the brief data accumulated to date, indications are that the coatings are beneficial, at least in extending the time-to-failure from stress-corrosion cracking. Author

N63-11446 Alloyd Electronics Corp., Cambridge, Mass.
INFLUENCE OF CARBON CONTENT AND SUBSTRUCTURE ON CLEAVAGE IN IRON SINGLE CRYSTALS
D. A. Hay and B. L. Averbach Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Apr. 1962 38 p 6 refs
(Contracts AF 33(616)-6454 and AF 33(616)-7091, Phase I)
(ASD-TR-61-686, Part I)

The influence of substructure and carbon content on the ductile-brittle transition temperature was studied in iron single crystals. It was found that increases in carbon content (from 0.0005% to 0.030%) raised the transition temperature considerably. Small amounts of prestraining at room temperature before subzero testing inhibited twin formation. In cases where twins were formed, many microcracks were found in twins and at twin boundaries in fractured crystals. In some cases, microcracks were also found in the matrix of fractured crystals. Author

N63-11458 Defense Metals Information Center, Batelle Memorial Inst., Columbus, Ohio
REVIEW OF RECENT DEVELOPMENTS: EVALUATION OF SPECIAL METAL PROPERTIES [Eighth DMIC Review, Sept.-Nov., 1962]
J. E. Campbell Dec. 28, 1962 3 p 10 refs

A review is presented of the evaluation of the mechanical properties of metals by special techniques or for special applications. The review covers low temperature behavior of metals, fracture of metals, and the embrittlement of metals by hydrogen. M.P.G.

N63-11521 Joint Publications Research Service, Washington, D.C.
ARTICLES ON PROPERTIES OF MATERIALS
A. Ya. Artamonov, A. A. Alent'yev, Ya. I. Gurovich, and V. M. Grosheva Dec. 27, 1962 14 p 6 refs Transl. of two articles from Mashinostroenie (Kiev), no. 5, Sept.-Oct. 1962 p 32-35 and 87-87
(JPRS-16854) OTS: $1.60

CONTENTS:
1. EFFECT OF CUTTING PARAMETERS ON THE QUALITY OF THE MACHINED SURFACE OF POROUS POWDER METAL MATERIALS A. Ya. Artamonov (Inst. of Metalloceram. and Spec. Alloys, Acad. of Sci. Ukrain. SSR) p 1-8 6 refs
2. INVESTIGATION OF THE PROPERTIES OF A SILICON CARBIDE-BASE CONSTRUCTION MATERIAL A. A. Alent'yev, Ya. I. Gurovich, and V. M. Grosheva (Kiev Polytech. Inst.) p 9-11

19 MATERIALS, NON-METALLIC

Includes: mechanical and physical properties of non-metals (e.g., plastics).

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-11206 Joint Publications Research Service, Washington, D.C.
THE STRUCTURE AND CERTAIN PROPERTIES OF GAS-FLAME COATINGS
K. S. Shlyakova Dec. 20, 1962 11 p 2 refs Transl. from Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR (Moscow), no. 10, 1962 p 194-201
(JPRS-16788) OTS: $1.10

Metallization was used to obtain high-temperature protective coatings. Gas-fired coatings of nichrome alloy and aluminum oxide on steel and chrome-nickel steel samples were used. An effort was made to determine: (1) the influence of heat treatment on microstructure of the coating and on its microhardness; (2) the role of undercoating in attaining cohesion between the coating and the base; (3) the effects of vacuum treatment on quality of spray coatings; and (4) comparative data on heat resistance. The conclusions drawn were: (1) Metallization provides a technically simple method of obtaining coatings of various compositions, simple or complex. (2) Subsequent heat treatment increases the density of the coating. (3) Vacuum treatment increases the oxidation resistance of the coating. A.S.

N63-11293 High Temperature Materials, Inc., Boston, Mass.
RESEARCH ON NEW AND IMPROVED THERMALLY PROTECTIVE FIBER REINFORCED COMPOSITE MATERIALS
F. E. Papalegis and R. G. Bourdeau Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Nov. 1962 31 p
(Contract AF 33(657)-8651)

The pyrolytic deposition process for the growth of graphite whiskers was investigated, and a better understanding of the growth process was obtained. An attempt is made to define the whisker nucleation process that does not appear to be different from the nucleation process that leads to the growth of normal pyrolytic graphite. The pyrolytic graphite process was further improved for the treatment of various forms of carbon and graphite filaments. Both the tensile strength and oxidation resistance of filaments treated with pyrolytic graphite are greater than for untreated material. The tensile strength was found to increase as the pyrolytic graphite thickness decreases. A composite fabrication study revealed that pyrolytic graphite treated carbon filaments produced composites having greater homogeneity than those obtained with the untreated filaments. Author

N63-11299 General Electric Co. Flight Propulsion Lab. Dept., Evendale, Ohio

HIGH STRENGTH GLASS FIBERS DEVELOPMENT PROGRAM Third Bi-Monthly Progress Report, November 20, 1962

D. L. Hollinger and H. T. Plant [1962] 20 p 16 refs
(Contract NOw-61-0641-c (FBM))

The state-of-the-art of fiber glass in present day filament winding is reviewed, i.e., intrinsic strength of the fiber glass, degree of surface damage existing in the fibers, and possible failure mechanisms. Problem areas encompass (1) those factors which affect the strength of the fiber in tension while it is an isolated monofilament, and (2) those which affect the performance of the fiber when it is incorporated into a composite structure and subjected to complex loading. B.J.C.

N63-11301 Smith (A. O.) Corp., Milwaukee, Wis.

EFFECT OF GLASS SURFACE CHEMISTRY ON WETTING, BOND STRENGTH AND BOND LIFE OF AN EPOXY RESIN Monthly Progress Report No. 9 Nov. 1-Nov. 30, 1962

F. W. Nelson Dec. 15, 1962 12 p 6 refs
(Contract NOw-62-0679-c (FBM))

The bond life studies continued to show the great influence of a coupling agent for increased bond life in aqueous environment. The alkali-deficient glass surface was the only example of good bond life in the absence of a coupling agent. Chemically cleaned, degassed, and a fractured surface formed by cleaving the glass in the resin for instantaneous wetting by the resin showed no improvement of bond life when exposed to water. Author

N63-11308 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

THERMAL EXPANSION IN AIR OF CERAMIC OXIDES TO 2200° C

T. H. Nielsen and M. H. Leipold Oct. 30, 1962 30 p 9 refs
(JPL-TR-32-297) OTS: $2.60 ph, $1.10 mf

Thermal-expansion measurements were made in an air atmosphere to 2200° C on polycrystalline single-phase ceramic oxides. Specimens were fabricated by hot-pressing, slip-casting, and isostatic pressing. Magnesium oxide was tested in both air and argon; calcium oxide, as well as magnesium aluminate, and aluminum oxide specimens were tested in air. Specimens were characterized as to purity, thermal history, apparent density, grain size, and lattice parameter. The coefficient of thermal expansion was not affected by changes in grain size or fabrication techniques. All of the specimens tested in an air atmosphere showed weight and lattice parameter stability, whereas the magnesium oxide tested in argon did not. When tested in an air atmosphere, magnesium oxide, aluminum oxide, and magnesium aluminate spinel showed a permanent expansion with a decrease in density at temperatures well below their melting points. Author

N63-11430 Wyandotte Chemicals Corp., Mich.

SYNTHESIS OF LOW TEMPERATURE CHEMICAL RESISTANT URETHANE ELASTOMERS Quarterly Progress Report No. 1 [1 July to 30 Sept. 1962]

S. Axelrod and W. Lajiness Oct. 1, 1962 23 p
(Contract DA 20-018-ORD-24883)

Investigations directed toward the preparation of urethane-urea elastomers have been initiated. A statistically designed set of experiments has been completed investigating 5 variables at two levels. Two aromatic diamines (MOCA and DCB) were compared at two levels of amine to hydroxyl ratio. Two aromatic diisocyanates (TDI and MDI) at two levels of concentration were also compared. Two polyols of 1500 equivalent weight were utilized to round out the five variables. These polyols are PLURACOL TP-4542 and Teracol 30. The use of ortho dichlorobenzidine (DCB) at a 1.5 NH_2/OH ratio in combination with tolylene diisocyanate and the polypropylene-ethylene ether triol came the closest to meeting the specification for an oil-resistant rubber with good low-temperature flexibility. Author

N63-11434 Watertown Arsenal Labs., Mass.

AN ANALYSIS OF CARBON CRYSTALLITE GROWTH KINETICS DURING GRAPHITIZATION

Aram Tarpinian and Craig Tedmon Nov. 1962 19 p 11 refs
(WAL-TR-851.5/1) OTS: $0.50

An analysis is made of the growth kinetics of carbon crystallites during annealing of a petroleum coke through the range of 2057° C to 2727° C. A single activation energy of 90 kcal/mol was found for the growth process. Author

N63-11444 Air Weather Service. 3rd Weather Wing, Offutt AFB, Nebr.

FORECASTING DENSITY ALTITUDE

Norman N. Richardson Nov. 30, 1962 34 p
(AWS-TR-165)

This report presents a nomogram and simple, step-by-step instructions for its use by AWS personnel when computing forecast values of density altitude. A particular feature of the system is a correction factor which permits the aircraft operator at a remote site to compensate for errors in the forecast temperature at that site. In addition, an extensive table of machine-computed density altitudes is given for use if desired. Technical Orders on recent helicopter models also contain a nomogram for computing density altitude, but the scale may be too small for the accuracy sometimes desired. Author

N63-11447 Rock Island Arsenal Lab., Ill.

HIGH STRENGTH CELLULOSIC MATERIALS THROUGH INTERNAL POLYMERIZATION Technical Report No. 2

L. W. Lynch Oct. 2, 1962 24 p 23 refs
(RIA-62-3289) OTS: $0.75

The internal polymerization of two monomers, acrylonitrile and methyl methacrylate, in three different types of paper, was accomplished using the free radical-catalysis mechanism. The reaction was conducted for two hours at approximately 72° C using benzoyl peroxide as the catalyst. Modified paper products containing 5% to 35% of polymer were prepared. The tensile properties (both wet and dry) and the stiffness increased on each type of paper with increases in polymer content. The polymerization of methyl methacrylate in each of the three types of paper resulted in large increases in the wet and dry tensile strength of the paper. Increases in the wet and dry tensile strength of filter paper (primarily alpha cellulose) were realized with the acrylonitrile treatment. Minor improvements, only, were realized with the acrylonitrile treatment of kraft paper (sulfate type) and target paper (ground wood type). The stiffness of the kraft and target papers increased by approximately 1.6% for every 1% increase in polymer content and the filter paper stiffness increased at approximately twice this rate. Some fungus resistance was imparted to the paper by the internal polymerization of methyl methacrylate. Author

N63-11517 National Aeronautics and Space Administration, Washington, D.C.

MATERIALS FOR SPACE EXPLORATION

Don D. Davis, Jr., George F. Pezdirtz, Leonard Roberts, Richard H. Kemp, and Hubert B. Probst 1962 47 p 92 refs Papers presented at Session U of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-27) GPO

CONTENTS:

1. SPACE ENVIRONMENT AND ITS EFFECTS ON MATERIALS D. D. Davis, Jr. (NASA. Langley Research Center) 11 p 25 refs
2. NONMETALLIC MATERIALS FOR SPACECRAFT G. F. Pezdirtz (NASA. Langley Research Center) 10 p 16 refs
3. ABALATION MATERIALS FOR ATMOSPHERIC ENTRY L. Roberts (NASA. Langley Research Center) 8 p 30 refs

4. FLOW AND FRACTURE PROBLEMS IN AEROSPACE VEHICLES R. H. Kemp (NASA. Langley Research Center) 8 p 5 refs
5. HIGH-STRENGTH MATERIALS RESEARCH H. B. Probst (NASA. Langley Research Center) 8 p 16 refs

N63-11519 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
HOMOGENEITY OF DIISOCYANATE-LINKED ELASTOMERS
A. J. Havlik Sept. 15, 1962 38 p 10 refs Previously issued as a preprint; for abstract see N62-17686 19-08
(NASA Contract NAS7-100)
(JPL-TR-32-334) OTS: $3.60 ph, $1.34 mf

A study was made of the homogeneity of a number of diisocyanate-linked elastomers prepared by a cast technique from polyoxypropylene glycol (POPG), toluene-2,4-diisocyanate (TDI), and either trimethylol propane (TMP) or toluene-2,4-diamine (TDA). Solubility and swelling, solution viscosity, and Shore hardness determinations were used as measures of homogeneity developed during cure. Elastomers whose properties differ by an order of magnitude between the exposed surface and the interior were obtained unless cured under vacuum in perfectly sealed molds. The extent of this effect depends upon the formulation of the elastomer and the conditions of cure. After cure, the mechanical properties of homogeneous elastomers were significantly modified by exposure to the ambient atmosphere. Values for the Shore hardness increased for all the elastomers studied. For one composition, additional measurements showed the values for Young's modulus and the tensile strength to increase and those for the ultimate elongation to decrease. The magnitudes of the changes usually were in the range of 50 to 100%, although some were as high as 5000%. The modification of properties depends upon the absorption of water from the atmosphere and is not entirely reversible in character. The changes in mechanical properties are not readily explained by either the reaction of water with residual isocyanate groups present in the elastomer or by water acting as a nucleating agent for the crystallization of the flexible polymer chains. Author

20 MATHEMATICS

Includes: calculation methods and theory; computers; data processing; and numerical analysis.

For related information see: 08 Communications; 09 Electronics; 10 Facilities; and 22 Navigation and Guidance.

N63-11001 Wisconsin U. Theoretical Chemistry Inst., Madison
QUANTUM MECHANICAL SOLUTIONS OBTAINED BY TRUNCATED REACTION OPERATORS
William J. Meath, S. Osvaldo Goscinski, Kenneth M. Sando, and Joseph O. Hirschfelder Nov. 21, 1962 12 p 10 refs
(NASA Grant NsG-275-62(4180); Contracts AF 33(657)-7311 and NOrd-15884)
(WIS-TCI-5, Ser. 3) OTS: $1.60 ph, $0.80 mf

The use of truncated basis sets, comprised of eigenfunctions of the unperturbed Hamiltonian H_o, is discussed as a practical method for obtaining (1) an approximate solution for the reaction operator equation, $E_q = E_q^{(o)} + \langle \phi_q | t | \phi_q \rangle$; (2) an approximate wave function for the perturbed system. The solution employs an iterative method which yields the matrix elements of the reaction aperator. Author

N63-11040 Naval Radiological Defense Lab., San Francisco, Calif.
COMPUTER-AIDED ANALYSIS OF GAMMA-RAY SPECTROMETER DATA
P. A. Read and F. M. Tomnovec Oct. 26, 1962 21 p 3 refs
(USNRDL-TR-592)

Gamma ray pulse height distributions are analyzed with the aid of a computer. The method is based on a library of standard distributions punched on IBM cards. To reduce a pulse height distribution into discrete peaks, appropriate standards are chosen from the library, and adjustment factors are provided so that the computer can fit the standards to the distribution. It removes each fit successively from the distribution and leaves us a record thereof. The removal facilitates subsequent fits. The records comprise a set of reduced distributions from which can be deduced the gamma ray spectrum of the source which gave rise to the original distribution. Author

N63-11054 New York U. Inst. of Mathematical Sciences, N. Y.
SIGNIFICANCE ARITHMETIC ON THE IBM 7090
Max Goldstein May 1, 1962 30 p 6 refs
(NYO-9190)

The 7090 at NYU has been modified to include a "Significance Mode" of operation which is intended to facilitate the identification of significant bits in the results of floating-point-arithmetic operations. The manner in which floating-point arithmetic is handled in this mode is discussed. Several numerical experiments using this mode are described, and comparisons are made with the ordinary "normalized mode." Examples include power series evaluation, linear equations solution, determinant evaluation, and matrix inversion. The main conclusion is that "Significance Mode" can be quite useful, and that no loss of accuracy is encountered with it as long as a few "guard bits" can be assumed with the initial data. Author

N63-11125 Massachusetts Inst. of Tech., Cambridge
FUNDAMENTAL INVESTIGATIONS IN METHODS OF OPERATIONS RESEARCH: SOLUTION OF THE TRAVELING SALESMAN PROBLEM BY DYNAMIC PROGRAMMING ON THE HYPERCUBE Interim Technical Report No. 18
Rómulo H. González Zubieta (M.S. Thesis) May 1962 112 p 9 refs
(Contract DA-ARO(D)-31-124-G158)
(AROD-968-34)

The traveling-salesman problem is described as the problem faced by the salesman who, starting at a certain city, has to visit each of n-1 given cities before returning to the original city. He must do this in such a way so as to minimize the distance or some other quantity that is dependent on the order in which the cities are visited. This paper constitutes a report on the method developed by the author for solving the traveling-salesman problem and on the computational results obtained with the same method. At the same time, several useful extensions are discussed at length. The method is based on the representation of the paths through the cities as paths on the edges of a hypercube. This formulation leads to a dynamic programming algorithm which is completely general on the type of traveling-salesman problems it can solve. Author

N63-11161 Stanford U. Applied Mathematics and Statistics Labs., Calif.
ESTIMATING MISSILE RELIABILITY
S. Blumenthal and J. Denton Oct. 26, 1962 19 p 4 refs
(Contract Nonr-225(52))
(Tech. Rept. 81)

The optimal allocation to targets of a stockpile of missiles on the basis of missile reliability tests is discussed. Since missiles are not completely reliable, the probability of a target being destroyed by one missile or n missiles is computed mathematically, using the factor R to represent missile reliability. The value of R must be determined by operational tests. The object is to have enough missiles allocated to the target so that its survival probability is small. Some amount of overassignment is preferable to the same amount of underassignment. Four methods for missile reliability estimation are presented. A.S.

N63-11162 Stanford U. Applied Mathematics and Statistics Lab., Calif.

OPTIMAL DESIGN OF EXPERIMENTS

Herman Chernoff Oct. 31, 1962 17 p 5 refs Presented at the Eighth Conf. on Design of Experiments in Army Research Development and Testing

(Contract Nonr-225(52))

(Tech. Rept. 82)

The theory of optimal design of experiments is discussed to point out practical applications for the statistician. Example problems are solved for designs which are asymptotically locally optimal. These optimal designs are shown to depend on the form of the matrix J(e) which is defined as Fisher's information matrix divided by the cost of the experiment, e. While the designs must be qualified as locally asymptotically optimal, they have the practical application of serving as a yardstick for comparison purposes and of indicating how the design can be modified with relatively low loss of efficiency. R.C.M.

N63-11198 Courant Inst. of Mathematical Sciences, New York U., N.Y.

DIFFERENCE SCHEMES WITH HIGH ORDER OF ACCURACY FOR SOLVING HYPERBOLIC EQUATIONS

Peter D. Lax and Burton Wendroff July 31, 1962 50 p 14 refs

(NYO-7759)

The limitation of the speed and memory of calculating machines places an upper bound on the number of meshpoints that may be used in a finite difference calculation. This means that in problems involving many independent variables (and for present-day machines, three is many) the mesh employed is necessarily coarse. Therefore in order to get reasonably accurate final results one must employ highly accurate difference approximations. The purpose of this paper is to set up and analyze such difference schemes for solving the initial value problem for first-order symmetric hyperbolic systems of partial differential equations in two space variables. Author

N63-11202 Joint Publications Research Service, Washington, D.C.

FORMULATION OF PROBABILITY OF TWO ECONOMIC PROBLEMS

A. A. Borovkov (Inst. of Math. of the Siberian Dept. of the Acad. of Sci. USSR) Dec. 18, 1962 10 p 2 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 146, no. 5, Oct. 1962 p 983-986

(JPRS-16738) OTS: $1.10

In the problem of a traveling salesman it is required to find the shortest closed route s(n) connecting n given points in an r-dimensional euclidean space. These points are considered as n independent realizations of the r-dimensional random value with a certain distribution function $F(x) = F(x_1, x_2, \ldots, x_r)$. In the following paragraphs, arranged random values evaluating s(n) (the route and its length will have the same designation) are set up in a quite simple manner. It appears, in particular, that with high n and some limitations of F(x) it is possible to indicate a simple rule for establishing route $s_1(n)$ in such manner that the relationship $n_1(n)/s(n)$ "almost always" will not exceed $1+p$, $p>0$. Evaluation of the number p is included. Author

N63-11204 Joint Publications Research Service, Washington, D.C.

SEVERAL NEW APPROACHES TO CALCULATING METHODS AND TREATMENT OF OBSERVATIONS

L. V. Kantorovich Dec. 20, 1962 13 p Transl. from Sibirskiy Mat. Zhur. (Moscow), v. 3, no. 5, Nov. 15, 1962 p 701-709

(JPRS-16783) OTS: $1.60

New methods of data processing are discussed and example problems are formulated. The methods are applied to calculating the value of a polynomial at a given point. The problems of applying these methods to observed values of energy points, such as gravitational or magnetic, are discussed. Possibilities of improving the existing algorithms are considered. R.C.M.

N63-11208 New York U. Inst. of Mathematical Sciences, N.Y.

NUMERICAL COMPUTATION OF HYDRODYNAMIC FLOWS WHICH CONTAIN A SHOCK

John Gary Feb. 1, 1962 18 p 5 refs

(NYO-9603)

This paper describes the result of numerical computations using a modification of the finite difference method, developed by Professor R. D. Richtmyer, for the computation of hydrodynamic flows which contain a shock. This method uses the Eulerian form of the hydrodynamic equations, is explicit, is of second-order accuracy, and is based on shock fitting rather than the introduction of artificial viscosity. The method is applied to a one-dimensional problem for which a solution can be computed by solving an ordinary differential equation. Author

N63-11283 Joint Publications Research Service, Washington, D.C.

EXTREMAL CONTROL SYSTEMS

P. Y. Akinin, B. O. Aref'yev, V. O. Mitroshyn, and P. I. Chinayev Dec. 26, 1962 36 p 20 refs Transl. of three articles from Avtomatyka (Kiev), no. 4, 1962 p 34-59

(JPRS-16837) OTS: $3.60

CONTENTS:

1. DYNAMIC REGIMES OF STEP CONTROL SYSTEMS (PART I) P. Y. Akinin p 2-11 5 refs
2. AUTO-OSCILLATION IN A RELAY EXTREMAL SYSTEM B. O. Aref'yev p 12-20 4 refs
3. EXPERIMENTAL INVESTIGATION OF SELF-ADJUSTING (EXTREMAL) SYSTEMS WITH A TRANSITORY MEMORIZING OF THE EXTREMUM V. O. Mitroshyn and P. I. Chinayev p 20-34 11 refs

N63-11327 RIAS, Baltimore, Md.

DIFFERENTIAL INEQUALITIES AND EXTENSION OF LYAPUNOV'S METHOD

V. Lakshmikantham [1962] 10 p 9 refs

(NASA Contract NASr-103; Contracts AF 49(638)-382 and DA-36-034-ORD-3514 RD)

OTS: $1.10 ph, $0.80 mf

Using a comparison principle and the concept of Lyapunov's function, various properties (including stability and boundedness) of differential and delay-differential equations have been considered. In this paper, another type of extension of Lyapunov's method is presented, and the stability and boundedness of differential inequalities instead of equations are considered. By this approach, it is possible to extend the theory of stability and boundedness to a larger class of functions which includes the class of solutions, or approximate solutions, of differential systems, and the class of solutions of perturbed differential systems. Author

N63-11343 RIAS, Baltimore, Md.

LYAPUNOV FUNCTIONS FOR THE PROBLEM OF LUR'E IN AUTOMATIC CONTROL

R. E. Kalman [1962] 9 p 10 refs Submitted for Publication

(NASA Contract NASr-103; Contracts AF 49(638)-382 and AF 33(657)-8559)

OTS: $1.10 ph, $0.80 mf

Lyapunov functions are developed which assure that the closed-loop control systems of the Lur'e problem are globally asymptotically stable. The Lur'e problem is solved by utilizing and extending the theorems of Popov, Yakubovich, and LaSalle, and the author's canonical structure theorem. R.C.M.

N63-11344 Aerospace Information Div., Library of Congress, Washington, D.C.

USE OF VARIATIONAL METHODS IN PROBLEMS OF VIBRATION OF LIQUID AND LIQUID-FILLED BODIES

Dec. 17, 1962 2 p Review of: N. N. Moiseyev et al Variatsionnyye Metody v Zadachakh o Kolebanii Zhidkosti i Tela s Zhidkost'yu (Sbornik) (Variational Methods in Problems of Vibration of Liquid and Liquid-filled Bodies (Collection of Articles)) Moscow, Acad. of Sci. USSR Computer Center, 1962 245 p
(AID-62-203) OTS: $1.10 ph, $0.80 mf

This paper describes a book which contains articles on the following: variational principles in the theory of vibration, dynamic stability of liquid-filled shells, oscillation of liquid in cylinders, equations of motion for aircraft tanks, and dynamics of a ship with liquid cargo. R.C.M.

N63-11352 RIAS, Baltimore, Md.
NOTE ON A PROBLEM IN OPTIMAL NONLINEAR CONTROL
W. M. Wonham [1962] 9 p 4 refs Submitted for Publication
(NASA Contract NASr-103)
OTS: $1.10 ph, $0.80 mf

The problem of minimizing the functional $\frac{1}{2}\int_0^T x_1^2\,dt$ for the system $\ddot{x}_1 = u, |u| \leq 1$, is solved by a method based on the Hamilton-Jacobi equation. Author

N63-11356 Rome Air Development Center. Space Defense Systems Lab., Griffiss AFB, N.Y.
SPACE SURVEILLANCE SYSTEM EVALUATION BY A METHOD OF PHOTOGRAMMETRIC RESECTION
Dean C. Merchant Oct. 1962 21 p 10 refs
(RADC-TDR-62-442)

The successful development of efficient data-handling procedures, in connection with photogrammetric computations using réseau type photography, has suggested the feasibility of handling the large number of resection solutions necessary in an accuracy evaluation program for a space surveillance system. The report develops the procedure for correcting the significant systematic errors in the measured coordinates, describes an adjustment for application to stabilized aerial photography, and finally, develops the method for calculating errors in the adjusted results. Theoretical investigations indicate that an accuracy of one foot (standard error) in location of the target aircraft along each axis for each ten thousand feet of altitude above the control is likely. Author

N63-11431 Michigan U., Ann Arbor
AN INTEGRAL EQUATION OCCURRING IN PLASMA OSCILLATIONS
R. S. B. Ong [1962] 7 p 3 refs Submitted for Publication
(NASA Grant NsG-22-59)
OTS: $1.10 ph, $0.80 mf

This article shows that one can deduce the stability of single-hump velocity distributions by means of an argument which avoids artificiality in the analysis. Author

N63-11448 Wisconsin U., Madison
BOUNDS FOR THE PRINCIPAL FREQUENCY OF NONUNIFORMLY LOADED STRINGS. APPENDIX. A RESULT ON REARRANGEMENTS
Binyamin Schwarz and Alfred Lehman Oct. 1962 33 p 7 refs
(Contract DA-11-022-ORD-2059)
(MRC-341)

Let A be the Jacobi matrix of order n for which the elements in the diagonal are equal to 2 and the elements in the super- and sub-diagonal are -1. Let $P = \{p_1,\ldots,p_n\}$ be a diagonal matrix with positive elements. Let $P^- = \{p_1^-,\ldots,p_n^-\}$ be the rearrangement of P satisfying the order relation $p_1^- \leq p_n^- \leq p_2^- \leq p_{n-1}^- \leq \ldots$. Let $\lambda_1(P)$ and $\lambda_1(P^-)$ be, respectively, the least characteristic values of the pencils $A - \lambda P$ and $A - \lambda P^-$. The main result of this paper states that $\lambda_1(P) \geq \lambda_1(P^-)$ and that $\lambda_1(P) = \lambda_1(P^-)$ implies $P = P^-$ or $P = {}^-P$, where ${}^-P = \{{}^-p_1,\ldots,{}^-p_n\}$, ${}^-p_i = p_{n+1-i}$, $i = 1,\ldots,n$. Author

N63-11449 Wisconsin U., Madison
ASYMPTOTIC POWER SERIES EXPANSIONS OF INTEGRALS INVOLVING A LARGE PARAMETER. PART I: LARGE SEPARATION OF ALL SINGULARITIES FROM THE SADDLE POINT
John P. Ulrich Oct. 1962 33 p 9 refs
(Contract DA-11-022-ORD-2059)
(MRC-344)

A brief review of methods used to obtain asymptotic power series expansions for contour integrals involving a large parameter is presented and criticism of these methods is given. An approach is then developed which produces a convergent series with a bounded remainder (error) for a particular class of such functions. These functions depend upon three parameters; a set of conditions involving the relative ranges of these parameters is given which is necessary and sufficient to the remainder being acceptably small. The new development depends heavily on full utilization of the region about the saddle point in which the integrand is analytic. The usual semiconvergent asymptotic power-series expansion is derived from the new results as a special case. Author

N63-11450 Wisconsin U., Madison
ASYMPTOTIC POWER SERIES EXPANSIONS OF INTEGRALS INVOLVING A LARGE PARAMETER. PART II: ONE SINGULARITY CLOSE TO THE SADDLE POINT
John P. Ulrich [1962] 24 p 8 refs
(Contract DA-11-022-ORD-2059)
(MRC-348)

The problem of a branch point or a pole close to a saddle point is considered. A convergent power series is developed for a particular class of integrals, with one such singularity close to the saddle point and all other singularities far away. A set of necessary and sufficient conditions for the utility of this series is given, and the series converges very rapidly if a particular parameter has large modulus. The special case for a first-order pole is also given a separate treatment since the analysis can be made relatively simple for that case. The convergent series lead directly, in all cases, to more tractable semiconvergent ones although no presentation is made in the latter form. Author

N63-11451 Wisconsin U., Madison
STEADY STATE HEAT CONDUCTION IN A CIRCULAR CONE
Subhendu K. Datta Oct. 1962 16 p 3 refs
(Contract DA-11-022-ORD-2059)
(MRC-347)

The steady-state heat conduction in a circular cone when a finite region of the surface of the cone is heated to a certain temperature is discussed. The temperature at a point in this region is supposed to be a function of the distance from the vertex of the cone. The solution has been given in series form and also in real integral form. The distribution of temperature on the axis of the cone has been plotted for a particular semiopening angle of the cone. Author

N63-11452 Wisconsin U., Madison
LINEAR TRANSFORMATIONS OF A FUNCTIONAL INTEGRAL, II
Thomas I. Seidman Oct. 1962 22 p 3 refs
(Contract DA-11-022-ORD-2059)
(MRC-346)

It was proved that the measure on R^∞, the countable direct product of real lines with the identical normally distributed measure

$$\mu_1(S) = (\sqrt{2\pi}\sigma)^{-1} \int_S \exp|-x^2/2\sigma^2|\,dx,$$

transforms (with a specified Radon-Nikodym derivative) to an equivalent (mutually absolutely continuous) measure under linear transformations of the form $T = I + A$ with A a nonsingular, Hilbert-Schmidt operator with finite trace (evaluated with respect to the

canonical basis). In the paper this result is extended to transformations of the form $T = U(I + A)$ where U is unitary and A nonsingular and Hibert-Schmidt but with no traceability condition imposed.
Author

N63-11453 Wisconsin U., Madison
SOME ASPECTS OF FUNCTIONAL INTEGRATION
Thomas I. Seidman Oct. 1962 25 p 22 refs
(Contract DA-11-022-ORD-2059)
(MRC-352)

This report compares and describes some of the relations between various theories of Gaussian integration over function space developed by N. Wiener, I. E. Segal, K. O. Friedrichs and H. N. Shapiro, J. Schwartz, et al. Author

N63-11454 Wisconsin U., Madison
MATRICES OF LINEAR OPERATORS
P. M. Anselone Nov. 1962 13 p 4 refs
(Contract DA-11-022-ORD-2059)
(MRC-362)

The classical Hamilton-Cayley theorem is extended as follows to matrices of operators on a Banach space B. Let $T = [a_{ij}I + K_{ij}]$, $i,j = 1, \ldots, m$, where the a_{ij} are scalars, I is the identity operator on B, and the K_{ij} are compact linear operators on B. Let $P(\lambda)$ be the characteristic polynomial of $[a_{ij}]$. Then P(T) represents a compact operator on the product space B^m. This theorem is applied to the study of the asymptotic behavior of a sequence of elements in B which satisfy a composite recursion formula. In addition, the theorem is generalized to an abstract algebraic setting. Author

N63-11455 Wisconsin U., Madison
THE LIFTING PROPERTY AND DIRECT SUMS
Robert Ryan Nov. 1962 9 p 4 refs
(Contract DA-11-022-ORD-2059)
(MRC-366)

A complete measure space has the lifting property if, and only if, the whole space is a direct sum of summable subsets plus, perhaps, a locally null set. Author

N63-11491 New York U. Inst. of Mathematical Sciences, N.Y.
A FINITE DIFFERENCE SCHEME FOR THE NEUMANN AND THE DIRICHLET PROBLEM
K. O. Friedrichs Aug. 8, 1962 44 p 3 refs
(Contract AT(30-1)-1480)
(NYO-9760)

A specific feature of the finite difference scheme here proposed is that in it the boundary condition and the differential equation are treated simultaneously. The scheme will result from a variational principle of the original differential equation problem, simply by using the Ritz method employing piecewise linear approximation functions. Thus a rather uniform treatment of boundary condition and differential equation will result. The coefficients of the substitute boundary condition will be given as the areas of sections of triangles cut out by the boundary; they are therefore not sensitive to variations of the direction of the boundary. An advantage of this approach is that the mean convergence of the solutions of the difference equations (including first difference quotients) to that of the differential equation is implied by the general theory and requires no special proof. Whether or not the scheme is useful in actual computation is still to be seen. The scheme for the Neumann problem of Laplace's equation is described; then its extension to systems of second order is discussed. A lower estimate for the eigenvalues of the matrix involved is given and how the scheme may be extended to the Dirichlet problem is indicated. Author

N63-11497 Joint Publications Research Service, Washington, D.C.
METHOD OF COMPLETE CONFOUNDING OF INTERACTIONS WITH SUB-BLOCKS IN FACTORIAL EXPERIMENTS WITH TWO, THREE, FOUR AND FIVE LEVELS OF EACH FACTOR
Wiktor Oktaba (Soils Dept., Higher Agr. School) Jan. 7, 1963 68 p 21 refs Transl. from Ann. Univ. Mariae Curie-Sklodowska, Lublin-Polonia: Sect. E., v. 11, 6, 1956 p 124-186
(JPRS-16992) OTS: $6.60

The paper presents the method of constructing and arranging factorial field experiments and other experiments with 2, 3, 4, or 5 levels of each factor according to the so-called rule of complete confounding. This rule gives up the idea of obtaining information on interactions of three or more factors, and in the case of an experiment with two factors it sacrifices part of information on two-factor interaction; instead, it aims at obtaining more accurate estimates of the remaining interactions, and especially of the main effects and two-factor interactions, which interest the investigator in most cases. This can be reached by dividing all combinations into subblocks (incomplete blocks) so that comparisons between the subblocks might represent the interactions which the experimenter is ready to give up.
Author

N63-11506 National Aeronautics and Space Administration, Washington, D.C.
DATA ACQUISITION FROM SPACECRAFT
John T. Mengel, Joseph W. Siry, Albert G. Ferris, William R. Bandeen, and Charles D. Kirsten 1962 58 p 35 refs Papers presented at Session J of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29)
(NASA-SP-16) GPO:

CONTENTS:

1. INTRODUCTION J. T. Mengel (NASA. Goddard Space Flight Center) 1 p
2. DATA PROCESSING FOR ORBIT DETERMINATION J. W. Siry (NASA. Goddard Space Flight Center) 13 p
3. DATA ACQUISITION AND PROCESSING FROM SCIENTIFIC SATELLITES A. G. Ferris (NASA. Goddard Space Flight Center) 6 p 1 ref
4. DATA PROCESSING FROM METEOROLOGICAL SATELLITES W. R. Bandeen (NASA. Goddard Space Flight Center) 19 p 13 refs
5. DATA ACQUISITION AT PLANETARY RANGES C. C. Kirsten (JPL) 17 p 21 refs

N63-11536 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
THE N-BODY CODE—A GENERAL FORTRAN CODE FOR SOLUTION OF PROBLEMS IN SPACE MECHANICS BY NUMERICAL METHODS
William C. Strack, Wilbur F. Dobson, and Vearl N. Huff Washington, NASA, Jan. 1963 94 p 11 refs
(NASA TN D-1455) OTS: $2.25

A general astronomical integration code designed for a large class of problems in space mechanics that may be solved by numerical integration is described. The equations of motion provide for the effects of up to eight gravitating celestial bodies, oblateness and aerodynamic forces from the celestial body at the problem origin, propulsion system thrust, and rotation of the body at the origin. Author

N63-11541 Joint Publications Research Service, Washington, D.C.
METHOD OF OBTAINING A COMPLEX ALGORITHM BY COMBINING SIMPLE ALGORITHMS
V. G. Lazarev and Ye. I. Piyl' Jan. 7, 1963 13 p 8 refs Transl. from Izvest. Akad. Nauk SSSR, Otdel, Tekh. Nauk: Energetika i Avtomatika (Moscow), no. 3, 1962 p 189-195
(JPRS-17001) OTS: $1.60

A method is presented for obtaining a complex algorithm by combining simple algorithms. The number of logical conditions and supplementary logical variables of the combined algorithm are described. In each of the combined algorithms, after determination of identical operators, the order of execution of the operators may differ for the same values of logical conditions. Because of this, supplementary variables, determining the appurtenance of the operator to any given algorithm, must be introduced into the combined algorithm. It is evident that not more than n variables may be used in the combination of S algorithms, where $2^n > S$. J.R.C.

21 METEOROLOGY

Includes: climatology; weather forecasting; lower atmosphere studies; and oceanography.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N63-11128 Congress. House. Committee on Science and Astronautics

SPACE AND THE WEATHER. PROGRESS OF METEOROLOGICAL SATELLITE DEVELOPMENT AND WEATHER MODIFICATION Report of the Committee on Science and Astronautics, U. S. House of Representatives, Eighty-Seventh Congress, Second Session, Aug. 28-30 and Sept. 4, 11, 13, and 21, 1962 Serial X

Washington, GPO, 1962

This report discusses the NIMBUS and TIROS meteorological satellite systems and the international aspects of their use. R.C.M.

N63-11142 National Aeronautics and Space Administration, Washington, D.C.

METEOROLOGICAL SATELLITES

Morris Tepper *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 85-101 (See N63-11137 03-01)

This paper on meteorological satellites covers the following: the feasibility of a meteorological satellite as an engineering system, important scientific measurements of the atmosphere, active international program of cooperation, and the launching of satellite systems that provide data on a regular basis for use in weather forecasting. J.R.C.

N63-11148 Weather Bureau, Washington, D.C.

SATELLITES AND WEATHER FORECASTING

David S. Johnson *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 165-173 (See N63-11137 03-01)

Earth-orbiting satellites provide meteorologists with a global observation platform from which measurements can be obtained to fill large voids between land-based observing stations. The facilities and techniques for processing Tiros observations for operational use in weather analysis and forecasting have been continuously improved. Meteorologists stationed at each of the satellite-data receiving stations rapidly process the cloud pictures received from the satellite and prepare cloud analyses in which the distribution, structure, and form of the clouds viewed by the satellite are depicted schematically on a map. J.R.C.

N63-11234 Texas U. Electrical Engineering Research Lab., Austin

A DIGITAL METEOROLOGICAL DATA-ACQUISITION SYSTEM Scientific Report No. 1

W. S. Mitcham Sept. 30, 1962 55 p
(Contract AF 19(604)-5556)
(Rept. 4-06; AFCRL-62-1087)

This report develops some aspects of the design of the digital meteorological data-acquisition system installed on the Cedar Hill Television Tower near Dallas, Texas. A discussion is made of the design decisions and techniques employed in developing this system. A detailed development of a novel temperature-difference measuring technique is presented. System design characteristics are presented as a detailed system block diagram. System operation and performance data are provided for the first year of operation. Author

N63-11271 Air Force Cambridge Research Labs., Bedford, Mass.

A PREVIEW, "THE U.S. STANDARD ATMOSPHERE, 1962"

Norman Sissenwine, Harry Wexler (Weather Bureau), and Maurice Dubin (NASA, Wash., D. C.) N.Y., Am. Rocket Soc. [1962] 8 p 11 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2678-62) ARS: $0.50 members, $1.00 nonmembers

The U.S. Standard Atmosphere, 1962, will extend well into satellite orbital altitude, 700 km. The basic atmosphere is described. Temperatures are 500 degrees warmer at 300 km in the 1962 version, with associated changes in density and other parameters. Comparisons of the new atmosphere with available data are presented. Other information that will be included in the new report, such as data on departures from the standard (for example, nearly 60 percent in density at one level in the lowest 90 km) is presented. The considerations given the solar activity and diurnal cycle are also indicated. The political mechanism by which this new atmosphere came into being is described. Author

N63-11437 Washington U., Seattle

PART A: ON VALLEY AND MOUNTAIN WINDS III. PART B: VALLEY WIND THEORY Final Report

Norman Thyer and K. J. K. Buettner July 1962 215 p 55 refs
(Contract AF 19(604)-7201)
(AFCRL-62-1082)

Results of an experimental investigation showed that a comprehensive theoretical model of a valley-wind system must show valley- or mountain-winds, slope-winds, and the appropriate antiwinds, and show the distribution of velocities over the whole of the region involved. Based on these experimental results, a valley-wind theory was formulated. The mathematical model employed succeeded in producing a system of simultaneous slope-winds, valley wind, and antivalley wind by simulating heating at appropriate parts of the boundary of a three-dimensional region in which the air was initially at rest. Main features of the circulation as it initially developed was shown and a comparison of the different developments which took place under certain variations of initial conditions was made. Two methods were proposed in which it might be possible to adapt the boundary conditions so that sources and sinks could be balanced realistically: one is to avoid a fixed-temperature gradient as a boundary condition at all points of the ground surface; the other would be to specify a gradient wind blowing across the system. I.v.L.

N63-11522 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM METEOROLOGIYA I GIDROLOGIYA [MOSCOW] (METEOROLOGY AND HYDROLOGY), NO. 10, 1962

V. G. Boldyrev, A. P. Savrukhin, Ye. M. Dobryshman, and V. M. Sklyarov Dec. 28, 1962 48 p 123 refs Transl. of eight articles from p 28-36, 50-52, and 57-64
(JPRS-16905) OTS: $4.60

CONTENTS:

1. ON THE USE OF SATELLITE-OBTAINED RADIATION MEASUREMENTS IN SYNOPTIC ANALYSIS V. G. Boldyrev (Central Weather Forecasting Inst.) p 1-11 6 refs

2. ATMOSPHERIC CURRENTS AT ALTITUDES OF 80-100 KM FROM OBSERVATIONS OF THE DRIFT OF METEOR TRAINS A. P. Savrukhin (Physico-Tech. Inst., Acad. of Sci. Turkmen SSR) p 12-17 6 refs
3. "PHYSICS OF THE ATMOSPHERIC BOUNDARY LAYER" D. L. Laykhtman and Ye. M. Dobryshman p 18-23
4. LITERATURE ON METEOROLOGY, HYDROLOGY AND OCEANOGRAPHY PUBLISHED IN 1961 p 24-34 111 refs
5. AT THE WORLD METEOROLOGICAL ORGANIZATION p 35-36
6. CONFERENCES, MEETINGS AND SEMINARS p 37-39
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8. AWARDS V. M. Sklyarov p 42-45

22 NAVIGATION AND GUIDANCE

Includes: autopilots; star tracking; inertial platforms; and traffic control.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; 20 Mathematics; and 29 Space Sciences.

N63-11277 RAND Corp., Santa Monica, Calif.

THE APPLICATION OF DYNAMIC PROGRAMMING TO OPTIMIZING THE ORBITAL CONTROL PROCESS OF A 24-HOUR COMMUNICATION SATELLITE

J. A. Burkhart and F. T. Smith N. Y., Am. Rocket Soc. [1962] 16 p 7 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962 Previously issued as RM-3255-NASA; for abstract see N62-15027

(Contract NASr-21(02))

(ARS Paper-2695-62) ARS: $0.50 members, $1.00 nonmembers

This paper discusses a method for optimizing the guidance or orbital control process for a 24-hour communication satellite. The process is concerned with transferring a satellite from its injected orbit to a hypothetical point moving in a nearby specified reference orbit. The reference orbit considered here is a circular, equatorial orbit with a period of one sidereal day. The optimization of this transfer process is accomplished by applying the techniques of dynamic programing. This essentially involves treating the orbit transfer as a multistage decision process and finding the optimal set of velocity vector increments to be applied to the satellite to accomplish the desired transfer subject to a constraint on the propulsive energy used. The numerical results indicate that the linearity assumptions and the iteration technique involved in the computation of the velocity vector increments are entirely satisfactory. The actual orbit resulting from the application of the computed velocity vector increments very closely approximates the desired orbit transfer. The results also indicate that the differential correction process used to determine the required corrections to the orbital parameters can introduce sizable errors when the required orbit transfer is too large. Author

N63-11354 Ecole Normale Supérieure. Laboratoire de Physique, Paris (France)

ANNUAL SUMMARY REPORT NO. 1

P. Baruch et al July 25, 1962 16 p 11 refs

(Contract AF 61(052)-543)

(AFCRL-62-788)

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1. RADIATION ENHANCED DIFFUSION IN SILICON J. C. Pfister and P. Baruch p 4-9 5 refs Presented at the Kyoto Conf. on Lattice Defects, Sept. 1962 Submitted for Publication
2. DESIGN OF A MICROCALORIMETER. STORED ENERGY MEASUREMENT IN IRRADIATED GERMANIUM J. Zizino p 10-13 5 refs
3. STUDY OF DEFECT MOBILITY IN IRRADIATED GERMANIUM Edith Davoust p 14-16 1 ref

N63-11507 National Aeronautics and Space Administration, Washington, D.C.

CONTROL, GUIDANCE, AND NAVIGATION OF SPACECRAFT

David H. Schmieder, John B. Winch, John D. McLean, John C. Houbolt, John D. Bird, Manuel J. Queijo, Rodney C. Wingrove, Brian F. Doolin, and John V. Foster 1962 56 p 70 refs Papers presented at Session K of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29)

(NASA-SP-17) GPO:

CONTENTS:

1. ADAPTIVE GUIDANCE S. H. Schmieder and J. B. Winch (NASA. Marshall Space Flight Center) 8 p
2. A SURVEY OF MIDCOURSE GUIDANCE AND NAVIGATION TECHNIQUES FOR LUNAR AND INTERPLANETARY MISSIONS J. D. McLean (NASA. Ames Research Center) 6 p 4 refs
3. GUIDANCE AND NAVIGATION ASPECTS OF SPACE RENDEZVOUS J. C. Houbolt, J. D. Bird, and M. J. Queijo (NASA. Langley Research Center) 14 p 6 refs
4. ATMOSPHERE ENTRY GUIDANCE AND CONTROL R. C. Wingrove (NASA. Ames Research Center) 14 p 57 refs
5. SPACE VEHICLE ATTITUDE CONTROL B. F. Doolin (NASA. Ames Research Center) 6 p 3 refs
6. GUIDANCE AND CONTROL COMPONENTS RESEARCH J. V. Foster (NASA. Ames Research Center) 6 p

23 PHYSICS, GENERAL

Includes: acoustics; cryogenics; optics; and thermodynamics.

For astrophysics see: 05 Astronomy and Astrophysics.

For related information see: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 24 Physics, Solid-State.

N63-11026 Atomic Energy Commission. Div. of Technical Information, Washington, D.C.

SPATIAL NON-STATIONARY MOTIONS OF SOLID MEDIUM WITH SHOCK WAVES

A. G. Bagdoev (Inst. of Math. and Mech., Acad. of Sci. of the Armenian SSR) Nov. 1962 293 p 65 refs Transl. by JPRS of the book "Prostranstvennye Nestatsionarnye Dvizheniya Sploshnoi Sredy s Udarnymi Volnami" Erevan, Publishing House of the Acad. of Sci. of the Armenian SSR, 1961

(AEC-TR-5400) OTS: $3.50

This report considers the problem of a shock wave moving along the surface of a half-space and penetrating into an ideal medium which occupies the lower half-space. It also considers the problems for the motion induced in liquids by axial vertical intrusions of solid bodies. The material covered in the penetration of pressure in a continuous medium occupying the lower half-space includes the following: equations and boundary conditions of the investigated problems; case of homogeneous liquid half-space for the linearized problem; penetration of pressure into an elastic half-space; Ray method of calculating the intensities of wave fronts; two-component medium; and the solution of the problem in the approximate and rigorous formulation. In the penetration of solid bodies in a half-space the material covered includes the following: penetration of slender

pointed body in a compressible homogeneous liquid; penetration of cone of finite aperture in an incompressible liquid; and the penetration of slender bodies in an inhomogeneous medium. J.R.C.

N63-11028 Utah Research and Development Co., Salt Lake City
TERMINAL BALLISTIC INVESTIGATION OF THE IMPACT AND EFFECT OF ULTRA HIGH SPEED MICRON-SIZE PARTICLES PRODUCED ON HYPERVELOCITY IMPACT [Final Report]
Emerson T. Cannon Eglin AFB, Fla., Air Proving Ground Center, Nov. 1962 177 p 7 refs
(Contract AF 08(635)-7099)
(APGC-TDR-62-69)

Results of the investigations of spray particle impact are reported. A method was devised to measure the velocity and calculate the diameter of the spray particle in flight. The crater produced at impact was measured to obtain the diameter, and several attempts to measure penetration and volume are described. A scaling law relating macro-size craters to micro craters produced at the same velocity is presented. Author

N63-11035 Air Force Cambridge Research Labs. Electronics Research Directorate, Bedford, Mass.
ON THE POSSIBILITY OF OBSERVING LASER ACTION FROM THE R_2 LINE IN RUBY Research Report
C. Martin Stickley Sept. 1962 12 p 4 refs
(AFCRL-62-716)

Normal laser action in ruby occurs only from the R_1 line (6943Å). From a knowledge of the absorption coefficients of the R_1 and R_2 lines, it is shown that it is theoretically possible to obtain oscillation from only the R_2 line (6929Å) at room temperature by using end-mirrors that have low reflectivity at 6943Å but high reflectivity at 6929Å. Oscillation at the R_2 line is not observed when broadband reflectors (silver) are used due to its strong coupling to the R_1 line. Author

N63-11136 California U., Berkeley, Lawrence Radiation Lab.
THE RANDOM-PHASE APPROXIMATION APPLIED TO ATOMIC STRUCTURE
Philip L. Altick (Ph.D. Thesis) Oct. 15, 1962 87 p 39 refs
(Contract W-7405-eng-48)
(UCRL-10510)

The random-phase approximation, developed in the study of the electron gas, is used as a framework for the calculation of atomic excitation energies, oscillator strengths, and photoionization cross sections. Numerical results are obtained for the $^1P^o$ states of beryllium, magnesium, calcium, zinc, and strontium. Excitation energies and oscillator strengths are presented for the three or four lowest discrete states. The cross sections are given in the energy range from 0.005 to 0.245, 0.405, or 0.605 atomic units above threshold, depending on the atom. It is found that the electron correlations cause a substantial improvement in the lowest-lying, "resonance," excitation energy, and oscillator strength, but their effect decreases rapidly with high excitation energy. The photoionization cross sections near threshold are greatly enhanced by the correlations, excepting beryllium, and are much larger than the experimental values for magnesium and calcium; however, the computed cross section is of the right order of magnitude for strontium. The disagreements are attributed to autoionization effects. Author

N63-11173 Eitel-McCullogh, Inc., San Carlos, Calif.
SURFACE EXPLOSIONS ON SOLIDS BY HIGH-DENSITY ELECTRON BOMBARDMENT Final Report
Oskar Heil and Siegfried Vogel Oct. 1962 31 p 2 refs
(Contract AF 19(628)-1606)
(AFCRL-62-904)

Electron bombardment provides a means of heating with high local energy concentration and definition. The object of this study is to investigate surface explosions and the structural changes of matter caused by high temperatures, large temperature gradients, and fast quenching rates connected with electron bombardment. Author

N63-11178 California U., Livermore. Lawrence Radiation Lab.
THE STATUS OF TRANSPORT PROPERTIES OF AIR
V. E. Schrock Sept. 25, 1962 32 p 166 refs
(Contract W-7405-eng-48)
(UCRL-7052) OTS: $0.75

This report explores the status of experimental data for air, and reviews the measurement problem and techniques and the predictions available from the general transport theory of Boltzmann. Because the constant-pressure specific heat is known to a high degree of accuracy, the Prandtl number is calculated from it and the best available viscosity and thermal conductivity. For this reason emphasis is given to viscosity and thermal conductivity. J.R.C.

N63-11179 California U., Livermore. Lawrence Radiation Lab.
THE THERMODYNAMIC FUNCTIONS FOR WATER IN THE RANGE −10 TO 1000° C AND 1 TO 250,000 BARS
W. E. Sharp (Calif. U., Los Angeles) Oct. 23, 1962 54 p 9 refs
(Contract W-7405-eng-48)
(UCRL-7118) OTS: $1.25

Tables of values of the thermodynamic functions for water are presented for the temperature −10° to 1000° C and for 1 to 250,000 bars. There will be an error of about 2% in the difference between the free energy at a given pressure and its 1-bar value along a given isotherm. The error in the enthalpy and internal energy will vary considerably since their values depend on the magnitude of the difference between the free energy and the TS term. J.R.C.

N63-11185 Joint Publications Research Service, Washington, D.C.
NEW MATERIAL ON THE DEVELOPMENT OF A NEGATIVE SPARK AND ITS COMPARISON TO LIGHTNING
I. S. Stekol'nikov and A. V. Shkilev (Power Inst. im. G. M. Krzhizhanovskiy) Dec. 17, 1962 12 p 13 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 145, no. 4, 1962 p 782-785
(JPRS-16722) OTS: $1.60

The development of a spark produced by pulse voltage in gaps −rod +plate and −rod +rod on plate was investigated by means of an electron-optical converter with light amplification. Analysis of data obtained made it possible to explain qualitatively the higher values of discharge voltage for the gap −rod +rod on plate. The development of the negative spark does not appear to compare to the mechanism of lightning formation. Static photographs show clusters and diffused glows at the ends of the split-off leaders and their branches which were concluded to represent the "pilot-leader" in lightning. Data obtained from this study refute this idea and indicate that the glows represent stepped leaders and "bundles of threads" from the tip of the developing leader. I.v.L.

N63-11186 Joint Publications Research Service, Washington, D.C.
OPTICS OF MILLIMETER WAVES AND RADIOASTRONOMY
A. Ye. Salomonovich Dec. 14, 1962 16 p 9 refs Transl. from Usp. Fiz. Nauk (Moscow), v. 127, no. 4, 1962 p 589-596
(JPRS-16686) OTS: $1.60

The work of P. N. Lebedev in light pressure and millimeter waves is reviewed, on the fiftieth anniversary of his death, and recent developments in these fields at the Lebedev Physical Institute are described. Developments reported include: (1) obtaining radioisophotes of the actual radiation of the Moon on the 8mm wavelength of a radiotelescope, and the variation with lunar phase of the brightness temperature of the lunar disc's center; (2) investigation of the radio

emission of Venus on the 8mm and 4mm wavelengths which indicate that the brightness temperature of the nocturnal side is close to 400° K; (3) observation of the millimeter radio emission of the Sun, Moon, and Jupiter during the passage of these planets through the cone of directions of the radiotelescope; (4) the study of the polarization of the radiation being received by means of recently developed ferrite modulators and quarter-wave plates, and the application of this study to individual areas of the solar disc and to the atmosphere and magnetic fields above sunspots. In general, the increasing sensitivity of the receiving equipment and the increasing stability of the oscillations being generated permit a corresponding increase in the number of discrete radio-emission sources accessible to measurement, while the development of optical amplifiers and coherent optical emitters permits the extension of ultrahigh frequency radio physics to the field of optics. M.P.G.

N63-11191 Brandeis U., Waltham, Mass.
RELAXATION OF QUANTUM MECHANICAL SYSTEMS
Peter Mengert (Ph.D. Thesis) July 1962 124 p 21 refs
(Supported by NSF)

A general theory of relaxation is developed. The equation for the time-development of expectation values is shown to be equivalent to the density matrix equation of Bloch (except for a correction in sign of one term). Requirements for the validity of the equation are developed. The relaxation of a quantum oscillator is investigated in both the free and driven cases. An expression for the power absorbed when the oscillator is driven by an external field is given. Equations for multiple-time correlation functions of relaxing-system quantities are given and applied to a spin ½ system. An analysis is set up for the relaxation of an oscillator in a case where memory effects can be included. Author

N63-11199 Argonne National Lab., Ill.
BENDING-MAGNET AND QUADRUPOLE ABERRATIONS FOR PARAXIAL RAYS
M. L. Good (Wisconsin U.) Nov. 1962 17 p
(Contract W-31-109-eng-38)
(ANL-6611)

Aberrations of bending magnets and quadrupoles for paraxial rays are discussed, with particular emphasis on isolating those effects likely to be of practical importance in high-energy separated beams. Author

N63-11225 Chicago U. Enrico Fermi Inst. for Nuclear Studies, Ill.
[THREE PAPERS SUBMITTED TO THE ASTROPHYSICAL JOURNAL, SEPTEMBER 1962]
S. Chandrasekhar and Norman R. Lebovitz Sept. 1962 84 p 27 refs
(Contract Nonr-2121(24))
(EFINS-62-54-55-56)

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1. ON THE SUPER-POTENTIALS IN THE THEORY OF NEWTONIAN GRAVITATION II. TENSORS OF HIGHER RANK S. Chandrasekhar and Norman R. Lebovitz (MIT) p 1-12 6 refs
2. THE POTENTIALS AND THE SUPER-POTENTIALS OF HOMOGENEOUS ELLIPSOIDS S. Chandrasekhar and Norman R. Lebovitz p 13-24 8 refs
3. ON THE POINT OF BIFURCATION ALONG THE SEQUENCE OF THE JACOBI ELLIPSOIDS S. Chandrasekhar p 25-46 13 refs

N63-11228 General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.
DEVELOPMENT OF PULSED NEUTRON APPLICATION TO POWER REACTOR START-UP PROCEDURES First Quarterly Progress Report, Apr. 1-June 30, 1962
Paul Meyer and Edward Garelis Wash., D. C., AEC Div. of Tech. Information, July 1, 1962 31 p 7 refs
(Contract AT(04-3)-189)
(GEAP-4047) OTS: $0.75

The purpose of this work is to develop a technique to use pulsed neutron sources to measure the shutdown of large, thermal power reactors. A theoretical investigation to identify an experimental observable is conducted. The experimental work presently centers around the problem of detecting neutrons in the presence of a high gamma field of about 10^7 R/hr. The latter fact renders conventional techniques with scintillation crystal and photomultiplier tube mounted in-core impractical, because of gamma pulse stackup. Author

N63-11229 Massachusetts Inst. of Tech., Cambridge
MULTI-GROUP DIFFUSION METHODS
K. F. Hansen Wash., D. C. AEC Div. of Tech. Information Apr. 1962 77 p 8 refs
(Contract AT(30-1)-2344)
(NYO-10206) OTS: $1.75

The purpose is to provide an introduction to the multigroup diffusion methods of reactor analysis. No new techniques of analysis are included. The mathematics has been kept simple, in order that the approximations at each step are clearly apparent. The adjoint function is introduced and the reasons for considering the adjoint are repeatedly stressed. The selection of numerical methods considered in the second section is by no means exhaustive. Simple illustrations of various iterative methods are included. Relations between the rates of convergence of various methods may be found in the references, along with proofs of various results. Author

N63-11307 France. Ministère de l'Air, Paris
ÉTUDE SUR LA DÉTERMINATION DES TEMPÉRATURES DE SURFACES (DE 0 À 400° C) PAR L'INTERMÉDIAIRE DES ÉMISSIONS DE MINCES REVÊTEMENTS PHOTOLUMINESCENTS [STUDY ON THE DETERMINATION OF SURFACE TEMPERATURES (FROM 0 TO 400° C) BY MEANS OF EMISSIONS FROM THIN PHOTOLUMINESCENT COATINGS]
Jean-Pierre Leroux Paris, Service de Documentation et d'Information Technique de l'Aéronautique (SDIT) [Oct.] 1962 92 p 34 refs
In French
(*Its* Publication Scientifique et Technique N. T. 119) Available from SDIT, 2, Ave. de la Porte d'Issy, Paris (15e)

The problem of determining the temperature of a surface is satisfactorily solved by using the thermal sensitivity of emissions from thin photoluminescent coatings deposited on the surface. The work presented includes: (1) extension of Thureau's method of using the spectral deformation of photoluminescent emissions excited by mercury lamp rays 365 to 366 mμ wavelength to give the influence of the coating thickness and the intensity of the excitation which it receives as a function of temperature; and (2) the study of a new method based on the thermal sensitivity of phosphorescence phenomena between 0° and 400° C. This method consists of permanently exciting a phosphorescent substance by a ray of near ultraviolet light (365 to 366 mμ) so that the intensity is a periodic function of time, and then using the evolution of the periodic time function under the influence of temperature corresponding to the intensity of a spectral band of emission. An apparatus has been developed which permits concurrent use of the two procedures, and examples of its use under various conditions are given. M.P.G.

N63-11325 Lessells and Associates, Inc., Boston, Mass.
ACOUSTIC EMISSION UNDER CYCLIC STRESS Report No. 3
Dec. 1, 1962 13 p 2 refs
(NASA Contract NASr-97)
(OTS: $1.60 ph, $0.80 mf

The construction of special test apparatus for experimental studies of acoustic emission under cyclic stress was completed and

placed into operation. Three specimens were cycled to failure. The data indicate the presence of emission prior to visual appearance of the fatigue crack. Author

N63-11332 Bureau of Mines. Berkeley Thermodynamics Lab., Calif.
HEATS AND FREE ENERGIES OF FORMATION OF CALCIUM TUNGSTATE, CALCIUM MOLYBDATE, AND MAGNESIUM MOLYBDATE
R[onald] Barany 1962 15 p refs
(BM-RI-6143)

The heats of formation at 298.15° K of calcium tungstate, calcium molybdate, and magnesium molybdate were determined by solution calorimetry. For the heats of formation from the elements, the values obtained were calcium tungstate, −402.4 ± 0.5 kcal/mole, calcium molybdate, −369.5 ± 0.3 kcal/mole, −334.8 ± 0.2 kcal/mole. For the heats of formation from the oxides, the values obtained were calcium tungstate, −49.2 ± 0.4 kcal/mole, calcium molybdate, −39.6 ± 0.1 kcal/mole, and magnesium molybdate, −12.9 ± 0.1 kcal/mole. Author

N63-11406 Rochester U. Inst. of Optics, N.Y.
PROBLEMS OF PHOTOGRAPHIC SPECTROPHOTOMETRY OF SHORT DURATION LIGHT PULSES: GRANULARITY, RECIPROCITY FAILURE, AND LATENT IMAGE STABILITY Final Report
Gordon G. Milne and James A. Eyer Aug. 31, 1962 88 p 13 refs
(Contract DA-49-146-XZ-008)
(DASA-1332)

CONTENTS:

1. MEASUREMENTS OF THE GRANULARITY OF PHOTOGRAPHIC EMULSIONS James A. Eyer p 1-1 – 1-9 3 refs
2. PHOTOGRAPHIC RECIPROCITY FAILURE Gordon G. Milne p 2-1 – 2-15 5 refs
3. THE STABILITY OF PHOTOGRAPHIC LATENT IMAGES James A. Eyer p 3-1 – 3-10 1 ref

Appendix

I. MICROSCOPE STUDIES OF PHOTOGRAPHIC EMULSIONS Gordon G. Milne p I-1 – I-5
II. PHOTOGRAPHIC RADIOMETRY BY INTERFEROMETRIC TECHNIQUES James A. Eyer p II-1 – II-5

N63-11418 Naval Ordnance Lab., Corona, Calif.
THE PHASE SHIFT OF THE HARMONIC OUTPUT OF TRIGLYCINE SULFATE AS A FUNCTION OF THE SIGN OF POLARIZATION
D. J. White Nov. 1, 1962 57 p
(NOLC-568)

A ferroelectric driven in a suitable circuit by a sinusoidal voltage will produce all harmonics of the driving field. A simple theory is developed to show that there is a 180-degree phase shift for all even harmonics if the sign of the ferroelectric polarization is reversed, and no phase shift for odd numbered harmonics. Experimentally, single crystal triglycine sulfate conforms rather well to the simple theory, with the deviations at least qualitatively explicable. Author

N63-11432 Maryland U. Inst. for Molecular Physics, College Park
RELATIONS AMONG POTENTIAL ENERGY CURVES OF DIATOMIC MOLECULES
J. T. Vanderslice and E. A. Mason Repr. from Advan. Mol. Spectry., 1962 p 323-330 13 refs
(NASA Grant NsG-5-59)

A simple quantum-mechanical method is presented for deriving useful relations among the potential energy curves of both bound and unbound states of diatomic molecules at large internuclear distances. The method is a modified perfect-pairing approximation for the electrons, and gives what is essentially a valence-bond expression for the potential energy, starting from a molecular-orbital description of the spectroscopic state involved. For molecules made up of atoms in the first row of the periodic table, the relations obtained by this scheme enable one to calculate the curves leading to ground-state atoms once any two curves are known. Potential energy curves for the different states of nitrogen, nitric oxide, and oxygen which dissociate to ground-state atoms have been calculated in this way, and good agreement with experiment is obtained. Author

N63-11433 Columbia Radiation Lab., New York, N.Y.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Ninth Quarterly Progress Report, December 16, 1961 through March 15, 1962
R. Novick Mar. 15, 1962 68 p 25 refs
(Contract DA-36-039 SC-78330)
(CU-3-62-SC-78330)

Several modifications of the 30-foot beam apparatus which will be used to measure the lifetime of the metastable state of helium ions are described. Level crossing experiments utilizing optical methods (double resonance methods) have been employed to measure the hyperfine Zeeman structure of isotopes of zinc, sodium, rubidium, and cadmium. Complete results are given for the radiative lifetime of the $^3P_1$ state of cadmium. Progress is described on several molecular physics projects, including molecular beams experiments employing velocity selection and electric resonance, and microwave and maser spectroscopy. Several advances in the optical maser program are described. Author

N63-11436 Technical Research Group, Syosset, N.Y.
RESEARCH ON PROPERTIES OF LASER DEVICES Second Quarterly Technical Summary Report, September 1962 through November 1962
M. Newstein and S. Rothberg, eds. [1962] 81 p refs
(Contract AF 49(638)-673; ARPA Order 356-62)
(TRG-134-QTR-2)

The variation of power output from a gaseous LASER when the frequency is scanned over the Doppler lineshape has been studied. A theory of perturbed cavities has been applied to the case of small curvature. An analysis has been made of the fluctuations in the output of a quantum detector of arbitrary quantum efficiency preceded by a LASER amplifier. Work continues on the development of optically pumped cesium gas LASERs designed to operate in the milliwatt range at 3μ and 7μ. The study of the possibility of utilizing photodissociated TlBr as a gaseous LASER medium was pursued. Crystalline and glassy media for rare-earth ions were studied. Oscillation has been achieved in a LASER cavity consisting of crossed roof prisms. Measurements of flashlamp absolute spectral brightness, available stored energy in ruby rod, and output pulse radiant energy have been made in order to determine the division of the overall efficiency of pulse ruby oscillators. Author

N63-11463 Joint Publications Research Service, Washington, D.C.
METHOD OF OPTICAL COMPENSATION OF LINEAR DISPLACEMENT IN PANORAMIC PHOTOGRAPHY
I. I. Yukhin Dec. 27, 1962 17 p 3 refs Transl. from Izvest. Vyssh. Ucheb. Zaved., Geod. i Aerofotos. (Moscow), no. 3, 1961 p 127-138
(JPRS-16853) OTS: $1.60

A theory of angular optical compensation for the linear displacement of the image in plane-panoramic aerial photography is presented; and a compensating assembly using a revolving mirror is proposed for use with a plane-panoramic camera. In this assembly, the mirror rotates at an angular velocity corresponding to the displacement velocity for certain image points; the mirror's axis of

rotation is parallel to the aerial film and to the perpendicular direction of image displacements. The condition of corresponding longitudinal overlap between adjoining frames of the photographs is met by adjusting the panoramic rate of the camera. M.P.G.

N63-11464 Joint Publications Research Service, Washington, D.C.
ANALOGY OF CHARACTERISTICS OF REPRODUCTION IN TELEVISION AND PHOTOGRAPHY
S. B. Gurevich (Physico-Chem. Inst. im. A. F. Ioffe, USSR Acad. of Sci.) Jan. 2, 1963 26 p 15 refs Transl. from Tekhn. Kino i Televideniya (Moscow), no. 11, Oct. 30, 1962 p 5-15
(JPRS-16930) OTS: $2.60

The article compares these characteristics of TV and photographic systems: signal-to-noise ratio; contrast and gradation transmission; resolving power and light-versus-signal characteristics. It discusses the possibility of an informational evaluation of reproduction quality and sensitivity. It deduces formulas for information capacity as well as for sensitivity of ideal and real systems. Author

N63-11490 Los Alamos Scientific Lab., N. Mex.
THE FIELD OF A MAGNETIC BUBBLE
B. R. Suydam Dec. 18, 1962 9 p
(Contract W-7405-eng-36)
(LAMS-2807)

A perfectly conducting sphere is immersed in a uniform magnetic field. If now the sphere is suddenly expanded or collapsed, it will induce motion of the field lines and hence give rise to a radiated signal. In this note, the resulting electromagnetic field is computed. Author

N63-11492 Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, NOVEMBER 1962
Albert V. Crewe Dec. 15, 1962 81 p 10 refs
(Contract W-31-109-eng-38)
(ANL-6658)

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   - A. TREAT p 66
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6. PUBLICATIONS p 71-74

N63-11498 Israel Program for Scientific Translations, Ltd., Jerusalem
MATHEMATICAL APPARATUS OF THE THEORY OF ANGULAR MOMENTUM
A. P. Yutsis, I. B. Levinson, and V. V. Vanagas (Inst. of Phys. and Math., Acad. of Sci., Lithuanian S.S.R.) 1962 168 p 73 refs Transl. by A. Sen and R. N. Sen of the book "Matematicheskii apparat teorii momenta kolichestva dvizheniya" State Publ. House of Pol. and Sci. Lit. of the Lithuanian S.S.R., Vilnius, 1960
(Published for NASA and NSF)
(NASA TT F-98; Inst. fiz. i mat. AN Litovskoi SSR, Publ. 3) OTS: $1.75

This book on the theory of angular momentum covers the following: addition of two angular momenta; addition of an arbitrary number of angular momenta; graphical methods for operations with sums of products of Wigner coefficients; j-coefficients and their properties; utilization of transformation matrices for obtaining sum rules and transformation formulas for jm-coefficients; examples of application of the graphical method; and irreducible tensor operators and expressions for their matrix elements. J.R.C.

N63-11516 National Aeronautics and Space Administration, Washington, D.C.
LABORATORY TECHNIQUES IN SPACE ENVIRONMENT RESEARCH
Howard E. Martens, Jack L. Taylor, Floyd B. Humphrey, and Daniel D. Elleman 1962 52 p 58 refs Papers presented at Session T of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-26) GPO:

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1. TECHNIQUES FOR ACHIEVING STEADY-STATE TEMPERATURES ABOVE 1500° C H. E. Martens (JPL) 6 p
2. HIGH-VACUUM TECHNIQUES FOR RESEARCH J. L. Taylor (JPL) 19 p 15 refs
3. TECHNIQUES FOR LABORATORY STUDIES OF MODERN MAGNETISM F. B. Humphrey (JPL) 18 p 30 refs
4. GENERATION OF MAGNETIC FIELDS BY FLUX COMPRESSION IN SUPERCONDUCTORS D. D. Elleman (JPL) 7 p 13 refs

N63-11539 Wheeler and Wheeler Associates, Branford, Conn.
RESEARCH IN CRYOGENICS AND MAGNETO-OPTICS [Final Report]
R. G. Wheeler and G. W. Wheeler Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 24 p 11 refs
(Contract AF 33(616)-8314)
(ARL-62-433)

A brief description of the magneto-optical and magnetic susceptibility research system installed at the Aeronautical Research Laboratories is given. Theoretical considerations are developed concerning the use of doped CdS and ZnS single crystals as ultra-low temperature paramagnetic salts. One concludes that $CdS:Mn^{+2}$ is a possible thermometric salt while $CdS:Eu^{+2}$ may be an excellent working salt. Theoretical considerations are made concerning the possibility of observing the molecular spectra associated with the impurity-exciton complexes in CdS and CdSe. It appears that of the four simplest complexes considered, the spectra associated with the ionized donor-exciton system are the most likely to be observed. The energetics and symmetries of these systems are considered for C_s symmetry. Author

N63-11544 National Bureau of Standards, Boulder, Colo.
CRYOGENIC RESEARCH AND DEVELOPMENT Seventh Progress Report to National Aeronautics and Space Administration for Period Ending September 30, 1962
R. J. Corruccini et al Sept. 30, 1962 40 p
(NBS-7607) OTS: $3.60 ph, $1.40 mf

CONTENTS:

1. PHYSICAL PROPERTIES OF HYDROGEN R. J. Corruccini et al p 1-2
2. CRYOGENIC INSTRUMENTATION J. Macinko et al p 3-15
3. CONSULTATION AND ADVISORY SERVICES D. B. Chelton et al p 16-18
4. THE COMPILATION OF THERMOPHYSICAL PROPERTIES OF CRYOGENIC MATERIALS R. B. Stewart and V. J. Johnson p 19-26
5. RESEARCH ON COOLDOWN OF CRYOGENIC TRANSFER LINES W. G. Steward et al p 27-28

24 PHYSICS, PLASMA

Includes: fusion; and magnetohydrodynamics.

For related information see: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N63-11009 Minnesota U., Minneapolis

STUDIES OF THE DYNAMIC PROPERTIES OF LANGMUIR PROBES

H. J. Oskam, R. W. Carlson, and T. Okuda Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 187 p 17 refs

(Contract AF 33(616)-7034)

(ARL-62-417)

The dynamic behavior of a Langmuir probe immersed in a gaseous plasma is studied by using various measuring techniques. The delay in the current collection is investigated as a function of probe potential and plasma parameters, and a qualitative theory based upon the motion of ions is presented. The capacitance of the probe sheath is calculated and compared with the measured values. In order to eliminate the influence of the stray probe capacitance on the measurements, a shielded Langmuir probe was developed. Author

N63-11124 National Aeronautics and Space Administration, Washington, D.C.

HYDROMAGNETIC WAVE PROPAGATION IN A CONSTANT DIPOLE MAGNETIC FIELD

John Carstoiu (Sylvania Electric Products, Inc.) Dec. 1962 37 p 24 refs

(NASA Contract NASr-18)

(NASA TN D-1689) OTS: $1.00

Basic concepts are first presented, and a theorem of decomposition for the rate of change of the magnetic field similar to the Cauchy-Stokes decomposition theorem in hydrodynamics is included. A theory of magnetohydrodynamic waves in the presence of a uniform magnetic field is presented, and some details on the geometry of dipole magnetic lines of force are discussed. Magnetohydrodynamic waves in a constant dipole magnetic field are described. Author

N63-11224 California U., Berkeley. Lawrence Radiation Lab.

A PLASMA—TRAVELING WAVE INTERACTION

Daryl D. Reagan June 5, 1962 8 p 5 refs

(UCRL-6947-T)

A traveling wave disturbance can move in the direction parallel to an axial magnetic field in a confined plasma, producing sinusoidal compression and expansion. Such a disturbance might, for example, be produced by external coils. Approximate solutions of the Boltzmann equation will be described, giving "perpendicular" and "parallel" temperatures, density, and axial drift speeds for electrons and ions, and for the induced axial electric field in such a disturbed plasma. Necessary conditions for a steady state (measured in a frame moving with the disturbance) will be discussed. This report will give results for disturbance frequencies near the electron collision frequency, but below the ion cyclotron frequency. A case will be described where the ion temperature is several times greater than the electron temperature. Author

N63-11238 Naval Radiological Defense Lab., San Francisco, Calif.

FLUX AND SPECTRAL MEASUREMENTS OF PRIMARY AND MODERATED NEUTRON SOURCES

E. Tochilin Oct. 8, 1962 27 p 18 refs

(USNRDL-TR-587)

Radioactive (α,n) neutron sources maintained by the U.S. Naval Radiological Defense Laboratory (USNRDL) include Ra-Be, PuF_4, and four $PuBe_{13}$ sources. Comparative neutron emission rates for these sources were determined by two separate methods. These included: (1) the manganese sulfate bath with appropriate corrections made for fast neutron escape or capture and for thermal neutron capture by the source, and (2) long counter measurements corrected for energy response and source anisotropy. Agreement to within 1 percent was obtained by the two independent methods. A Ra-Be source calibrated against the National Bureau of Standards neutron standard was used as a primary reference. Spectral measurements of $PuBe_{13}$ and PuF_4 neutron sources were made with nuclear emulsions. By the use of cylindrical plastic and lead absorbers, an effort was made to moderate the $PuBe_{13}$ spectrum and thereby obtain additional calibration points for instrument response studies. Spectral changes were initially studied with the double-moderator technique, followed by later measurements with nuclear emulsions. From flux and spectral measurements of the primary and moderated radioactive sources, the first collision tissue dose was calculated and, in turn, compared to experimental measurements of absorbed dose with proportional counters designed according to the Bragg-Gray principle. Author

N63-11260 MHD Research, Inc., Newport Beach, Calif.

THE EXPERIMENTAL PERFORMANCE OF A CROSSED-FIELD PLASMA ACCELERATOR

V. H. Blackman and R. J. Sunderland N.Y., Am. Rocket Soc. [1962] 8 p 6 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(NASA Contract NAS5-1120)

(ARS Paper-2633-62) ARS: $0.50 members, $1.00 nonmembers

The results of an experimental program to develop a steady state crossed-field accelerator are presented. A study has been made of the thrust developed by the accelerator as a function of the various operating parameters, of the lifetime of the components for different accelerator geometries, and of the behavior of the working fluid. A major portion of the experimental effort was directed toward the solution of material-erosion problems. A satisfactory arrangement has been devised which enables high-powered tests to be conducted with little erosion of the accelerator components. Power levels up to 60 kw were used in the crossed-field acceleration section with mass flow rates as low as 0.3 gm/sec of argon. Experiments were performed with both confined- and open-duct accelerators. A confined duct was operated with several gases, and the relative merits of each of these gases for crossed-field accelerator application is discussed. Empirical relationships for the open-duct accelerator have been obtained which describe the thrust as a function of the field parameters and the mass flow rate of the expellant. With the open-duct geometry, thrusts of the order of one pound have been achieved with argon at specific impulses greater than 1000 seconds. Author

N63-11289 Westinghouse Electric Corp. Westinghouse Research Labs., Pittsburgh, Pa.

A CLOSED LOOP MHD DEVICE WITH CESIUM SEEDED HELIUM

W. S. Emmerich, G. L. Griffith, R. L. Hundstad, T. C. Tsu, and S. Way July 12, 1962 25 p 3 refs

(Contract AF 33(657)-8311)

(Scientific Paper 62-118-266-P3)

A closed loop magnetohydrodynamic device, consisting of a motor section and a generator section connected to end plenum passages, has been designed and partially constructed. Helium, seeded with cesium, will circulate in the loop by the driving force of the MHD motor. Power may be drawn off from the generator section while the gas is circulating so that no large gas supplies, heat exchangers or compressors are needed. This device will be used to study the operating characteristics of the MHD motor, generating ducts, and plasma properties under long-time operating conditions, and also to study material durability under actual MHD duct conditions. M.P.G.

N63-11347 Princeton U. Plasma Physics Lab., N.J.
QUARTERLY REPORT COVERING THE PERIOD APRIL 1-JUNE 30, 1962
AEC Div. of Tech. Information, Aug. 14, 1962 43 p 3 refs
(Contract AT(30-1)-1238)
(MATT-Q-19) OTS: $1.00

Studies in plasma physics are reported in the following areas: stellarator studies, ohmic heating, afterglow, and plasma probes; cesium plasma source; spectroscopy; development of plasma generators; and plasma theory. R.C.M.

N63-11515 National Aeronautics and Space Administration, Washington, D.C.
PLASMA PHYSICS AND MAGNETOHYDRODYNAMICS IN SPACE EXPLORATION
Adolf Busemann, Robert V. Hess, George P. Wood, Paul W. Huber, Clifford H. Nelson, and Macon C. Ellis, Jr. 1962 78 p 129 refs
Papers presented at Session S of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962
(See N63-11502 03-29)
(NASA-SP-25) GPO:

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1. RELATIONS BETWEEN AERODYNAMICS AND MAGNETOHYDRODYNAMICS A. Busemann (NASA. Langley Research Center) 8 p 2 refs
2. FUNDAMENTALS OF PLASMA INTERACTION WITH ELECTRIC AND MAGNETIC FIELDS R. V. Hess (NASA. Langley Research Center) 24 p 46 refs
3. THE ELECTRIC DRAG FORCES ON A SATELLITE IN THE EARTH'S UPPER ATMOSPHERE G. P. Wood (NASA. Langley Research Center) 9 p 10 refs
4. PLASMA FREQUENCY AND RADIO ATTENUATION P. W. Huber and Clifford H. Nelson (NASA. Langley Research Center) 14 p 35 refs
5. SURVEY OF PLASMA ACCELERATOR RESEARCH M. C. Ellis, Jr. (NASA. Langley Research Center) 21 p 36 refs

25 PHYSICS, SOLID-STATE

Includes: semiconductor theory; and masers.

For related information see: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N63-11034 Air Force Cambridge Research Labs., Bedford, Mass.
SINGLE CRYSTAL BISMUTH TELLURIDE
A. C. Yang and F. D. Shepherd, Jr. (M.S. Thesis—MIT) Sept. 1962 43 p 26 refs
(AFCRL-62-362)

Bismuth telluride single crystals have been grown by the Czochralski pulling method in a furnace similar to that used by Ainsworth. Bismuth rich and stoichiometric melts led to p-type crystals. Large excesses of tellurium and doping with Cu_2Te led to n-type crystals. Single crystal growth was sustained at rates as high as 8.5 cm/hr from p-type melts and 0.5 cm/hr from n-type melts. Growth rates above 3 cm/hr resulted in rectangular cross sections. Those below 1 cm/hr resulted in elliptical cross sections similar to those reported by Ainsworth. Typical cross section dimensions were 1.5 × 0.5 cm. Single crystals have been grown up to 22 cm in length. The variation of thermoelectric power, α, with melt composition was observed for compositions near stoichiometry. Normal p-type thermoelectric powers (Seebeck coefficient) ranged from 220 $\mu v/^\circ C$ to +260 $\mu v/^\circ C$ depending upon the amount of excess bismuth. Normal n-type thermoelectric powers of −15 to −250 $\mu v/^\circ C$ were obtained, with best results for growth rates below 0.5 cm/hr in n-type crystals. X-ray diffraction lines observed agree with the ASTM index to within experimental error. A transmission edge was observed at approximately 0.145 ev. Author

N63-11183 Corning Glass Works, N.Y.
INVESTIGATION OF THE MECHANISM OF SINGLE CRYSTAL GROWTH IN HIGH TEMPERATURE SYSTEMS Final Report, June 1961-June 1962
J. A. Marley and T. C. Mac Avoy Sept. 1962 116 p 9 refs
(Contract AF 19(604)-8447)
(AFCRL-62-771)

High temperature vapor deposition techniques have been successfully adapted to the growth of single crystals of tin (IV) and cadmium oxides. Crystallization and growth were studied under both neutral and oxidizing conditions and the various parameters effecting crystal size, purity and perfection were evaluated. The use of a helium-oxygen gas mixture for vapor transport was found to substantially benefit the growth process by eliminating both bulk and surface defects. Also, a discussion is presented of past electrical measurements performed on tin oxide films and ceramics together with some of the difficulties in interpreting nonsingle crystal data. The results of resistivity, Hall effect and optical measurements on tin oxide single crystal, grown by the present method are reported together with an analysis of the data. Author

N63-11189 Massachusetts Inst. of Tech. National Magnet Lab., Cambridge
A HIGH PERFORMANCE D.C. MAGNET UTILIZING AXIAL COOLED DISKS
H. Brechna and D. B. Montgomery Sept. 1962 71 p 15 refs
(Contract AF 19(604)-7344)
(NML-62-1)

A 1-inch bore, iron-clad, water-cooled solenoid recently built utilized a new hexagonal cooling pattern and a number of other new design features. It produced a field of 130 kg at 1.75 megawatts. Expressions for the G-factor, power per unit volume, heat flux, temperature rise, and burnout power are given for magnets using hexagonal patterns for axial cooling. Author

N63-11220 Services Electronics Research Lab., Baldock (Gt. Brit.)
EXCITED STATES OF COPPER IN SEMICONDUCTORS
R. J. Cherry and J. W. Allen *In its* S.E.R.L. Technical Journal, v. 12, no. 3, Oct. 1962 p 128-133 3 refs Presented at the International Conference on Semiconductors, Exeter U., July 1962 (See N63-11218 03-09)

A possible approach to a theory of deep-lying impurities in semiconductors might be made through crystal field theory, which has been successfully applied to impurities in ionic compounds. A program has been initiated to study transition metal impurities in a number of II-VI and III-V semiconductors to see how far crystal field

theory can be applied to increasingly covalent materials. Some preliminary measurements of the absorption spectra of some copper-doped semiconductors are presented. Some of the results can be interpreted on a simple model in which copper acts as a substitutional impurity. Another type of spectrum is also observed, however, which suggests that copper may also be incorporated in the lattice in a rather complex manner. Author

N63-11221 Services Electronics Research Lab., Baldock (Gt. Brit.)
NON-OHMIC EFFECTS IN GALLIUM ARSENIDE AT LOW TEMPERATURES
D. J. Oliver *In its* S.E.R.L. Technical Journal, v. 12, no. 3, Oct. 1962 p 134-139 6 refs Presented at the International Conference on Semiconductors, Exeter U., July 1962 (See N63-11218 03-09)

The variation of the current and the Hall coefficient with applied electric fields up to 60 V cm^{-1} has been determined for temperatures between 4° K and 30° K. Electrons are excited by the field from shallow donor levels into the conduction band and it was found that the conduction mobility in high fields is proportional to $F^{\frac{1}{2}}$ and is independent of the lattice temperature. A theoretical discussion of this result is given from which it is concluded that the electron mobility is mainly limited by ionized impurity scattering while energy loss takes place largely via the polar optical modes. Author

N63-11290 Massachusetts Inst. of Tech. Lab. for Insulation Research, Cambridge
[INSULATION RESEARCH STUDIES]
Nov. 1962 51 p refs
(Contracts AF 19(604)-5482 and Nonr-1841(10))

CONTENTS:

1. DYNAMIC SQUARENESS IN POLYCRYSTALLINE GARNETS B. W. Lovell and D. J. Epstein 15 p refs (See N63-11291 03-25)
2. DYNAMIC BEHAVIOR OF DIFFUSION-DAMPED FERROMAGNETIC DOMAIN WALLS James F. Janak 32 p refs (See N63-11292 03-25)

N63-11291 Massachusetts Inst. of Tech. Lab. for Insulation Research, Cambridge
DYNAMIC SQUARENESS IN POLYCRYSTALLINE GARNETS
B. W. Lovell and D. J. Epstein *In its* [Insulation Research Studies] Nov. 1962 15 p refs (See N63-11290 03-25)
(Tech. Rept. 173)

Certain samples of polycrystalline yttrium iron garnet and lutetium iron garnet have been found to exhibit domain-wall relaxation and magnetic anneal effects. In these same materials there are striking anomalies in the behavior of the hysteresis loop. These garnets do not behave like the usual square-loop materials but exhibit "dynamic squareness," a phenomenon heretofore unreported. Detailed studies of loop behavior, made with triangular wave-current excitation, show that, at a fixed temperature, squareness has its onset when the slope of the triangular wave exceeds a critical value. Within the region of squareness, the coercive force is essentially independent of peak excitation, while for excitation below threshold, where the loop is normal, the coercive force decreases with decreasing frequency. For cores excited at low temperature by a step function of applied field, there is a range of step amplitudes for which the core response is a pulse, delayed substantially from the beginning of the step; the amount of delay decreases with increasing field strength. For LuIG, delays of >500 μsec have been observed. These unusual effects appear to be due to domain-wall instabilities which have their origin in a diffusion aftereffect mechanism. Author

N63-11292 Massachusetts Inst. of Tech. Lab. for Insulation Research, Cambridge
DYNAMIC BEHAVIOR OF DIFFUSION-DAMPED FERROMAGNETIC DOMAIN WALLS
James F. Janak (M.S. Thesis) *In its* [Insulation Research Studies] Nov. 1962 32 p refs (See N63-11290 03-25)
(Tech. Rept. 174)

The dynamic behavior of 90-degree and 180-degree (001)-plane domain walls, when acted upon by a nonlinear, time-varying damping force due to magnetic field-induced diffusion of particles within the sample, is investigated. The Néel model of diffusion aftereffect is used to obtain the diffusion-damping force, in the form of an integral over the previous displacement of the wall, and the resulting integrodifferential equation for wall motion is studied for steps, ramps, and triangular waves of applied field. The results of the analysis are in qualitative accord with experiments done on polycrystalline samples, but the analysis predicts only the detailed behavior of a single polycrystalline grain. The problem of a concerted action of grains, which is necessary if the polycrystal is to behave like a single crystal, is the only major disadvantage of this theoretical treatment and remains unexplained. The similarity between theoretical predictions and experimental work is so striking, however, that it is reasonable to conclude that field-induced diffusion offers a basic explanation of experimental results, with an additional, not necessarily unrelated, effect occurring in conjunction with it in polycrystals. Author

N63-11311 Massachusetts Inst. of Tech. Lab. for Insulation Research, Cambridge
ELECTRIC AND MAGNETIC PROPERTIES OF V_2O_3 AND RELATED SESQUIOXIDES
Archie J. Mac Millan (Ph.D. Thesis) Oct. 1962 35 p 24 refs
(Contracts AF 19(604)-5482 and Nonr-1841(10))
(Tech. Rept. 172)

In the room-temperature (corundum) phase, V_2O_3 is highly conducting ($\sigma = 10^2$ ohm^{-1} cm^{-1}) and appears intrinsically to be a degenerate p-type semiconductor. The electrical behavior is relatively insensitive to deviations from the correct metal-to-oxygen ratio. Based on a one-carrier model, hole concentration is estimated to be 10^{22}/cm^3 and mobility 2 cm^2/volt sec. Below the first-order transformation at ca. 160° K, V_2O_3 is an oxidation-reduction semiconductor with p-type conduction occurring in samples containing excess oxygen, n-type in reduced samples. In this phase, the semiconducting properties are susceptible to valency control. Substitution of Mg^{2+} for V^{3+} leads to p-type behavior, while Zr^{4+} additions give n-type properties. Mobilities at 125° K are estimated at 0.02 cm^2/volt sec for holes, 0.08 cm^2/volt sec for electrons. Mg and Zr substitutions increase the magnetic susceptibility above that of V_2O_3. Solid solutions of V_2O_3 with the sesquioxides of Al, Sc, Cr, and Ti have also been studied. The sesquioxides of Al, Sc, Cr, which in themselves are highly resistive semiconductors, when added to V_2O_3 in small concentrations (2 to 4 mole %) increase the resistivity of the room-temperature phase by about 2 decades, change the character of the conduction process from metallic to semiconducting, and increase the temperature of the transition between the two phases. The resistivity of the low-temperature phase is only slightly affected. Upon further substitution the transition temperature is depressed and the electrical properties begin to approach those of the added sesquioxides. The effect on the transition temperature is in contrast with that found for Mg and Zr substitutions, which always depress the temperature of transition. Solid solutions with Ti, which forms a highly conducting sesquioxide, are high conducting and p-type in both phases after about five mole percent Ti substitution. Author

N63-11334 Electro-Optical Systems, Inc., Pasadena, Calif.
FEASIBILITY STUDY TOWARD DEVELOPMENT OF RADIATION RESISTANT SOLAR CELL Monthly Report, 1 July through 31 July 1962
S. Kaye Aug. 15, 1962 17 p
(NASA Contract NAS7-92)
(EOS-2080-ML-9) OTS: $1.60 ph, $0.80 mf

Fabrication of radiation-resistant solar cells of the graded base n-on-p type and p-on-n type is discussed and evaluated. Whether the

cells were illuminated from front or back indicated no difference as to the general curve characteristics of the oscilloscope traces or to the time required for the output voltage to reach its maximum value. I.v.L.

26 PROPELLANTS AND COMBUSTION

Includes: fuels; igniters; and oxidizers.

For related information see: 07 Chemistry; and 27 Propulsion.

N63-11007 Ohio State U. Rocket Research Lab., Columbus

EXPLOSION LIMIT STUDIES OF NITROUS OXIDE AND NITROUS OXIDE-NITROGEN-AIR MIXTURES TO 200 ATM. AND 1800° R

Juris O. Krisjansons, Loren E. Bollinger, and Rudolph Edse Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 40 p 4 refs

(Contract AF 33(616)-5615)

(ARL-62-431)

Explosion limits have been determined in a 117.5 cm^3 cylindrical reaction chamber for pure nitrous oxide and mixtures consisting of N_2O + 0.25 air, N_2O + 0.88N_2 and N_2O + 0.88N_2 + and N_2O + 0.88N_2 + 0.50 air. Two types of ignitors were employed; a 0.005-inch copper wire was melted by applying 31 volts d.c. to its terminals and a 0.020-inch diameter platinum glow-wire was heated with approximately 210 watts a.c. Results of these experiments are presented in the form of pressure-temperature explosion-limit diagrams. The explosion-limit curve for nitrous oxide follows an exponential path for both ignitors. Author

N63-11008 Ohio State U. Rocket Research Lab., Columbus

CHEMICAL KINETICS OF NITROUS OXIDE DECOMPOSITION AT ELEVATED PRESSURES AND TEMPERATURES

E. Stokes Fishburne and Rudolph Edse Wright-Patterson AFB, Ohio Aeronautical Research Labs., Sept. 1962 40 p 17 refs

(Contract AF 33(616)-5615)

(ARL-62-430)

Kinetic studies of the thermal decomposition of nitrous oxide were conducted in the temperature range from 1000° to 2500° K. The decomposition of nitrous oxide behind the reflected shock wave in a shock tube was investigated using photographic techniques. It appears that the rate of decomposition may be governed by the vibrational relaxation time of the lower energy valence bond. Induction times for the rapid decomposition of nitrous-oxide range from 152 microseconds at 1430° K agree qualitatively with approximate values obtained by other investigators. Author

N63-11022 Army Chemical Center, Edgewood, Md.

MODIFIED TYPE B-2 FUMING NITRIC ACID SERVICING SEMI-TRAILER [Final Report]

Edwards AFB, Calif., 6593 Test Group (Development), Nov. 1962 96 p

(Contract AF MIPR (33-616)60-20)

(SSD-TDR-62-174)

This report documents the results of modifying a standard MCREXE 3-212 servicing trailer manufactured by the Texas Metal and Manufacturing Company, Dallas, Texas. The objective was to provide a self-contained servicing trailer, capable of producing high and low flow rates, for fuming nitric acid. The resultant trailer provided a means of servicing missiles with a highly corrosive storable propellant and may have established design criteria for similar trailers. Author

N63-11029 Polytechnic Inst. of Brooklyn, N.Y.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF SUPERSONIC COMBUSTION [Interim Report]

Antonio Ferri, Paul A. Libby, and Victor Zakkay Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 131 p 53 refs

(Contracts AF 33(616)-7661)

(ARL-62-467)

A theoretical and experimental investigation of mixing and supersonic combustion is presented. Then an analysis of inviscid flow fields with a finite rate chemistry for a hydrogen-air reaction is given. An analysis of a turbulent mixing for flows with large density gradients with no chemical reaction is presented. The analysis is compared with the experimental results. Results of the experiments in supersonic combustion are given. Author

N63-11133 Army Chemical Center, Edgewood, Md.

MODIFIED TYPE A-1B UDMH & HYDRAZINE SERVICING TRAILER. VOLUME I: OPERATION AND SERVICE INSTRUCTIONS; VOLUME II: PARTS BREAKDOWN; VOLUME III: OVERHAUL INSTRUCTIONS [Final Report]

Edwards AFB, Calif., 6593 Test Group (Development), Nov. 1962 206 p In 3 vols.

(Contract AF MIPR (33-616)60-20)

(SSD-TDR-62-176)

Detailed information is given containing parts nomenclature, material and operating specifications, plus the proper sequence for replacing parts. Author

N63-11134 Army Chemical Center, Edgewood, Md.

A TEST SERIES CONDUCTED TO DETERMINE THE FEASIBILITY OF USING WATER FOG OR A THERMAL UPDRAFT TO CONTROL OR DISPERSE THE FUMES RESULTING FROM SPILLS OF NITROGEN TETROXIDE

Edwards, Calif., 6593 Test Group (Development), Nov. 1962 16 p

(Contract AF MIPR (33-616)60-20)

(SSD-TDR-62-177)

Evaluation is given of different methods of preventing large, concentrated clouds of nitrogen tetroxide (NO_2) from traveling for extended distances at ground level as the result of large volume spills. Author

N63-11160 Bureau of Mines. Explosives Research Lab., Pittsburgh, Pa.

REVIEW OF FIRE AND EXPLOSION HAZARDS OF FLIGHT VEHICLE COMBUSTIBLES [Final] Technical Documentary Report [April 1961-April 1962]

George S. Scott, Henry E. Perlee, George H. Martindill, and Michael G. Zabetakis Wright-Patterson AFB, Ohio, Flight Accessories Lab., Oct. 1962 50 p 11 refs

(Contract AF 33(616)-60-8)

(ASD-TR-61-278, Suppl. 1)

The prevention of fires and explosions involving the combustibles and oxidants likely to be found in flight vehicles requires a knowledge of the flammability and related characteristics of these materials. This report, the second in a series, presents the results of experimental studies of certain phases of the general problem where information was lacking or insufficient. These include: ignition energy requirements and limits of flammability of selected combustibles in oxidants other than air, effect of blending of fuels on the spontaneous ignition temperature, effect of temperature on the limits of flammability and minimum oxygen requirements for flame propagation of selected combustibles, behavior of layered vapor and liquid-vapor mixtures in various oxidizing atmospheres, behavior of flame arrestors in static and in laminar and turbulent flowing mixtures. Author

N63-11164 Polytechnic Inst. of Brooklyn, N.Y.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF SUPERSONIC COMBUSTION

Antonio Ferri, Paul A. Libby, and Victor Zakkay Sept. 1962 130 p 53 refs

(Contract AF 49(638)-217)

(PIBAL-713)

A theoretical and experimental investigation of mixing and supersonic combustion is presented. A review of the problem under investigation is given. Then an analysis of inviscid flow fields with a finite rate chemistry for a hydrogen-air reaction is presented. An analysis of a turbulent mixing for flows with large density gradients with no chemical reaction is presented. The analysis is compared with the experimental results. The results of the experiments in supersonic combustion are presented. Author

N63-11187 Polytechnic Inst. of Brooklyn, N.Y.

GRAVITATIONAL STRESSES IN A CYLINDRICAL, ORTHOTROPIC, VISCOELASTIC SOLID PROPELLANT GRAIN

Jerome M. Klosner and Mahmoud Sadre Oct. 1962 33 p 10 refs

(Contract Nonr-839(32) (FBM))

(PIBAL-660)

The quasi-static analysis of a long, circular, orthotropic, viscoelastic, cylindrical solid-propellant grain supported rigidly at its outer surface and subjected to gravitational stresses acting perpendicular to its longitudinal axis is presented. The solution is obtained by use of a generalized Laplace transform and the inversion integral is evaluated for short and very long times. An exponential form suggested by Bleich and Sachman is then used to obtain results for the complete time range. A comparison is made between the orthotropic viscoelastic, orthotropic elastic, and the isotropic elastic solutions of the same problem for three shell thicknesses. Author

N63-11273 Martin Co., Baltimore, Md.

THERMAL ASPECTS OF LONG-TERM STORAGE OF PROPELLANTS ON THE LUNAR SURFACE

Tibor Buna N.Y., Am. Rocket Soc. [1962] 37 p 15 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2690-62) ARS: $0.50 members, $1.00 nonmembers

The passive thermal control aspects of above-surface storage of propellants on a lunar equatorial site are examined. A method is developed for predicting vaporization rates, mean temperatures and temperature amplitudes of insulated propellants exposed to stabilized-periodic heating in the lunar environment. It is shown that, with modest investment in required insulation weights, propellant temperature levels comparable to earth-ambient temperatures may be maintained indefinitely on the lunar surface, and boil-off rates of cryogenic propellants may be kept within acceptable limits for storage times up to several lunar cycles. The feasibility of artificially modifying the effective reflectivity of the lunar surface is established, and the effect of such modification on performance is evaluated. The relative effects of surface optical properties, insulation heat transfer mechanism (conduction versus radiation) and the spatial and temporal distribution of the environmental radiation intercepted by the container are discussed in the light of three insulation concepts. Author

N63-11329 Martin Co., Denver, Colo.

CRYOGENIC PROPELLANT STRATIFICATION ANALYSIS AND TEST DATA CORRELATION

Thomas B. Jefferson (Arkansas U.), Thomas Bailey, Richard Vande-Koppel, and Gary Skartvedt [1962] 29 p 2 refs

An analytical model for prediction of temperature stratification in liquids is developed. This analysis permits the rocket designer to calculate liquid-propellant temperature and vapor-pressure histories during flight. The method is based on integration of the internal free-convection boundary layer along the portion of the tank wall exposed to aeroheating. Data are presented which show that the analysis successfully predicts the degree of temperature stratification measured in ground and flight tests with liquid oxygen and liquid nitrogen. Author

N63-11330 Plasmadyne Corp., Santa Ana, Calif.

PROPERTIES OF PLASMAS AS THEY PERTAIN TO THERMAL ARC-JETS [Final Report, 15 Feb. 1961 to 15 Feb. 1962]

Joseph Meltzer, C. J. Chen, R. Greco, Q. McKenna, G. Mitcheltree, R. Price, and W. Stoner Wright-Patterson AFB, Ohio, Aeronautical Systems Div., Aug. 1962 140 p 50 refs

(Contract AF 33(616)-8173)

(ASD-TDR-62-451)

The purpose of this study is to present information which will aid in selecting propellants for use in electrothermal engines. Several potential propellants were examined. These include hydrogen, ammonia, helium lithium hydride, nitrogen, methane, air, argon, and lithium. The report includes discussions of important propellant properties and their effect on engine performance and life. The effect of the propellant choice on the operation of the arc jet is considered. This includes examining theoretical thrustor efficiency, engine life and the effect of the engine's mission. Experiments were performed for eight propellants using Plasmadyne's one-kilowatt engine. The results of these tests are discussed. Author

N63-11351 France. Ministre de l'Air, Paris

STABILITÉ DE LA COMBUSTION VIBRATOIRE DANS LE BRULEUR A RÉSONANCE [STABILITY OF VIBRATORY COMBUSTION IN A RESONANCE BURNER]

Jean-Claude Leyer Paris, Service de Documentation et d'Information Technique de l'Aéronautique (SDIT), Sept. 1962 70 p 17 refs In French

(*Its* Publication Scientifique et Technique N. T.-117) Available from SDIT, 2, Ave. de la Porte-d'Issy, Paris (15e)

A study was made of the functional characteristics of resonating burners without check valves and without forced feed while burning at frequencies from 100 to 300 Hertz. The influence of the nature of the fuel and the system of injection on the stability of the pulsing function was determined. Results of a study of gas motion and pressure evolution in the combustion chamber were used to construct a theoretical cycle for this burner. This study showed that the initiation of a resonating combustion regime is not assured if the duration of the combustion is not at least one quarter of the total cycle time. Trans. by M.P.G.

N63-11538 Ohio State U. Rocket Research Lab., Columbus

DETONABILITY OF NITROUS OXIDE AT ELEVATED INITIAL PRESSURES AND TEMPERATURES

James A. Laughrey, Loren E. Bollinger, and Rudolph Edse Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 27 p 19 refs

(Contract AF 33(616)-5615)

(ARL-62-432)

The detonability of nitrous oxide was investigated at initial temperatures from 23° to 210° C (533° to 870° R) and at initial pressures from 21.4 to 207.1 atmospheres in a high-pressure detonation tube during any of the experiments. Some explosions, however, were encountered. The maximum impact pressure was 3.66 times greater than the initial pressure as measured by a quartz crystal transducer. The time intervals of the reactions (from ignition to the maximum pressures) lasted from one to four seconds which indicated that relatively slow reactions occurred. The results show that nitrous oxide will decompose and burn deflagratively under the conditions employed; at certain higher initial pressures and temperatures some explosions occurred. Author

27 PROPULSION

Includes: airbreathing, electric, liquid, nuclear, and solid propulsion.

For related information see: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N63-11120 Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio

STEELS FOR LARGE SOLID-PROPELLANT ROCKET-MOTOR CASES

J. E. Campbell Nov. 20, 1962 34 p 35 refs
(Contract AF 33(616)-7747)
(DMIC-178)

This report briefly identifies the major high-strength steel alloys used for large solid-propellant rocket-motor cases and reviews the mechanical properties that may be obtained with each of the alloy groupings. The importance of fracture toughness is identified, and the results of burst tests are discussed. Author

N63-11141 National Aeronautics and Space Administration, Washington, D.C.

NUCLEAR ENERGY: THE SPACE EXPLORATION ENERGY SOURCE

Harold B. Finger *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 71-84 (See N63-11137 03-01)

This paper on nuclear rockets and nuclear electric propulsion systems covers the following: experimental nuclear rocket engine Nerva, nuclear electric power and propulsion system, the Snap-8 electrical generating system, magnetohydrodynamic accelerators, and plasma engines. J.R.C.

N63-11170 Douglas Aircraft Co., Inc. Missile and Space Systems Div., Santa Monica, Calif.

SEGMENTED ROCKET MOTOR CASE PROGRAM Quarterly Progress Report No. 1 April 15-July 15, 1962

R. G. Carpenter and T. R. Jeffus Aug. 17, 1962 106 p 16 refs
(Contract AF 04(611)-8184)
(SM-42097)

This is an interim report on a research and development program directed toward design, development, fabrication, and testing of lightweight motor-case segments, culminating in a design applicable to large (160- to 240-in. diameter) segmented solid-propellant rocket motors. The report includes a discussion of the basic motor-case segment design concept, of the design of a 43-in. dia. subscale motor-case segment, and of the test program being conducted to implement the segment design. A summary of work accomplished on the 43-in dia. segments and on the test program is included. Completed tests are described in detail and detail drawings of the 43-in. dia. segment and its proof test assembly are included. Analytical techniques developed to assist in segment design and a strength analysis of the 43-in. dia. segment design are included. Author

N63-11171 Douglas Aircraft Co., Inc. Missile and Space Systems Div., Santa Monica, Calif.

SEGMENTED ROCKET MOTOR CASE PROGRAM [Second] Quarterly Progress Report No. 2, 15 July-15 October 1962

R. G. Carpenter and T. R. Jeffus Oct. 29, 1962 88 p 15 refs
(Contract AF 04(611)-8184)
(SM-42516)

This is an interim report on a research and development program directed toward design, development, fabrication, and testing of lightweight motor case segments, culminating in a design applicable to large (160- to 240-in. dia.) segmented solid propellant rocket motors. A summary of work accomplished on the bench test program and on the 43-in. dia. subscale segments is included. Completed tests are described in detail. A computer program developed for the determination of stresses in lap joints and a revised strength analysis are included. Author

N63-11174 Union Carbide Nuclear Co., Oak Ridge, Tenn.

CONSTRUCTION OF ORIENTED FLOW DEVICES

C. J. King and E. G. Farrier Dec. 7, 1962 22 p 3 refs
(Contract W-7405-eng-25)
(K-1549) OTS: $0.50

Ideas and techniques for construction of oriented flow devices are presented. The devices are cylinders with pores in the wall oriented to direct gas into the cylinder with a tangential component of velocity for the purpose of generating a vortex. These devices are of interest in connection with gaseous fission reactors. Author

N63-11263 Plasmadyne Corp., Santa Ana, Calif.

CURRENT STATUS AND PROSPECTS OF ELECTROTHERMAL PROPULSION

Russell J. Page N.Y., Am. Rocket Soc. [1962] 48 p 57 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2649-62) ARS: $0.50 members, $1.00 nonmembers

This paper gives a survey of the present status of electrothermal propulsion with trends toward future development. It discusses the various types of devices generally associated with this class of electric propulsion. The arc jet, which is simple in appearance, is reemphasized to be quite complex in its myriad interrelationship of many disciplines. The present state of the art is shown to be the result of primarily empirical-experimental work. The role of the relatively high thrust-to-power ratio electrothermal engine in future space missions is briefly reviewed. Author

N63-11264 Electro-Optical Systems, Inc., Pasadena, Calif.

CURRENT STATUS AND PROSPECTS OF ION PROPULSION

John M. Teem and George R. Brewer (Hughes Res. Labs.) N.Y., Am. Rocket Soc. [1962] 63 p 28 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2650-62) ARS: $0.50 members, $1.00 nonmembers

The current status and future prospects of ion propulsion are reviewed. General background information is briefly presented to provide orientation of the nonspecialist. The current status of work in ion propulsion is categorized and described in several areas. These include thrustor development, applied research on ion sources, propellant control subsystems development, power conditioning subsystem development, performance testing, and application studies. Several areas are noted in which important developments can be expected in the near future. These include increased emphasis on life and reliability experimental evaluation, results from early flight tests of prototypes, increasing experience with system interactions and development of prototype systems, and increases in demonstrated overall performance levels. The importance and character of future work in this field is also discussed. Author

N63-11265 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

DEVELOPMENT OF ELECTRIC PROPULSION POWER SYSTEMS

David G. Elliott N.Y., Am. Rocket Soc. [1962] 37 p 24 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(ARS Paper-2652-62) ARS: $0.50 members, $1.00 nonmembers

A summary is presented of progress in the development of space powerplants for electric propulsion. The following areas are discussed: auxiliary power supplies, propulsion power supplies, basic

powerplant problems, and conversion cycles. Auxiliary powerplants of increasing power level and decreasing specific weight will become available over the next few years to permit attitude and trajectory control with small electric thrustors. The decision to develop large space powerplants for prime propulsion has now been made, and development at the 300- to 1000-kw level is proceeding. Three types of conversion systems (turboelectric, thermionic, and liquid MHD) appear to be developable to long-life, lightweight space powerplants. D.B.

N63-11266 National Aeronautics and Space Administration, Washington, D.C.

THE ROLE OF ELECTRIC PROPULSION IN FUTURE SPACE PROGRAMS

Ira R. Schwartz and Ernst Stuhlinger (NASA. Marshall Space Flight Center) N.Y., Am. Rocket Soc. [1962] 73 p 19 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2654-62) ARS: $0.50 members, $1.00 nonmembers

This paper attempts to focus and direct research and development efforts on electric propulsion systems by analysis of the payload capabilities of nuclear electric spacecraft in the four major areas of space activity, i.e., unmanned interplanetary exploration, manned interplanetary exploration, ferry freight for logistic support, and satellite raising and orbital station keeping. Comparisons of electric rocket payload data are made with chemical rocket data. Electric propulsion systems will not parallel chemical and nuclear systems but will complement them in a decisive way. Results are presented of recent studies which the NASA research centers and contractors have made of the capabilities of nuclear-electric powered spacecraft for solar system exploration. The results are in terms of terminal mass or gross payload as a function of total flight time for the various missions investigated. D.B.

N63-11267 Space Technology Labs., Inc., Canoga Park, Calif.

BEAM NEUTRALIZATION TEST OF A FLIGHT MODEL ELECTRON BOMBARDMENT ENGINE

Robert F. Kemp, J. M. Sellen, Jr., and Eugene V. Pawlik (NASA. Lewis Research Center) N.Y., Am. Rocket Soc. [1962] 38 p 10 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(NASA Contract NAS3-2199)

(ARS Paper-2663-62) ARS: $0.50 members, $1.00 nonmembers

Results of a series of beam neutralization tests of an electron bombardment engine's neutralizer system under simulated space conditions are reported. Measurements of the gross characteristics of the plasma exhaust beam indicate that no buildup of potential above that of the neutralizer occurs within the plasma because of a lack of space-charge neutralization when the neutralizer is operating in the space-charge-limited mode in any of the neutralizer configurations tested. Although potentials were less than ten volts above that of the neutralizer for all the configurations reported, the lowest values were recorded for those configurations having the closest geometrical coupling to the beam. Measurements of neutralizer lifetime in the presence of erosion due to ion bombardment indicate that the present design has a more than adequate lifetime for the actual spaceflight test. Tests of a shielded neutralizer configuration indicate the possibilities of a shielded neutralizer system for operational spacecraft propulsion applications. M.P.G.

N63-11268 Electro-Optical Systems, Inc., Pasadena, Calif.

STUDIES OF A GAS DISCHARGE CESIUM ION SOURCE

R.C. Speiser and L. K. Branson N. Y., Am. Rocket Soc. [1962] 21 p 3 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(NASA Contract NAS8-2511)

(ARS Paper-2664-62) ARS: $0.50 members, $1.00 nonmembers

The characteristics of an electron-bombardment ion source using cesium as an expellant have been studied. The arc characteristics and operation of the source are consistent with analytical considerations and no anomalies were observed. Cathode configurations heated entirely by power delivered from the arc provide mass utilization efficiencies of 90% at about 650 ev/ion. In an engine configuration this type source has achieved overall engine efficiencies of 70% to 80% at specific impulses of 6000 to 8500 seconds. Author

N63-11295 Westinghouse Electric Corp. Westinghouse Research Labs., Pittsburgh, Pa.

REDUCTION OF OPERATING TEMPERATURE OR GENERATOR LENGTH IN MHD POWER PLANTS

S. Way June 18, 1962 21 p 4 refs

(Sci. Paper 62-111-600-P2)

Procedures are presented for lowering the operating temperature of a magnetohydrodynamic (MDH) steam powerplant. The relationship between the MDH generator length, efficiency, and temperature is discussed to indicate the conditions to be modified. The powerplant under consideration has the following characteristics: 1200° K = air preheat temperature, seeding ratio = 0.001 Cs, $B = 3$ web/m^2, p_3, = 1 atm, and $\eta_c = 0.85$. The following modifications are discussed: increased seeding with cesium ore (pollucite), reheat cycle, exhaust blower to reduce pressures, and replacing the copper-wound electromagnet with a cryogenic superconducting magnet. The temperature drop with fixed length and efficiency was 60° K, 200° K, 40° K, and 150° K respectively. R.C.M.

N63-11439 Pratt and Whitney Aircraft, East Hartford, Conn.

RESEARCH AND DEVELOPMENT OF TITANIUM ROCKET MOTOR CASE. Eighth Quarterly Technical Report [Apr. 1-June 30, 1962]

H. Alan Hauser and W. E. Helfrich July 31, 1962 79 p

(Contract DA-19-020-ORD-5230)

(PWA-2087; WAL-TR-766.2/1-7)

The work planned under the various phases of the program is outlined and the results of current investigations are reported. These results include the following: (1) smooth tensile properties (70° F) of subscale 14-inch diameter flow-turned cylinder vacuum-annealed prior to flow-turning; (2) cyclic loading test results on TIG-welded B-120 VCA and Ti-6Al-4V titanium alloys and AISI H-11 steel; (3) tensile properties (70° F) of Ti-6Al-6V-2Sn alloy rolled ring and TIG weldments; (4) tensile properties (70° F) of full-scale 40-inch diameter front and rear domes press-forged in closed dies at 1750° to 1800° F; (5) tensile properties (70° F) of full-scale 40-inch diameter rolled rings after solution treatment at 1450° F and after resolution treatment at 1800° F; and (6) flow-turning results on subscale 14-inch diameter rolled rings. The results are discussed and tentative conclusions drawn. Author

N63-11441 Little (Arthur D.) Inc., Cambridge, Mass.

DEVELOPMENT OF PYROLYTIC REFRACTORY MATERIALS FOR SOLID-FUEL ROCKET MOTOR APPLICATIONS Final Report

Ronald Francis July 10, 1962 77 p 20 refs

(Contract DA-19-020-ORD-5490)

(WAL-TR-766.41/2-3)

The development of a number of experimental approaches and furnace designs for material preparation is described, with both induction and resistance heating techniques being employed. The deposition of pyrolytic graphite as a model system is characterized, and the variation of its crystal structure, the approach of values of lattice parameters to single crystal values, particularly with increased deposition temperature and heat treatment, is observed. A broad experimental approach undertaken to develop refractory metal alloys of a number of systems in concentrations to one percent is described. Lattice spacings, crystallite sizes, density, and microstructure, virtually indistinguishable from unalloyed pyrolytic graphite

prepared under equivalent conditions, are found. Evidence of carbide formation is also found. The development of analytical techniques and low-temperature (1550° F) oxidation in laboratory atmospheres are also discussed. For rocket-motor nozzle test firings, the program was particularized to pyrolytic graphite and its low-concentration boron, silicon, and zirconium alloys and pyrolytic boron nitride. A particularly low pyrolytic graphite erosion rate of 0.26 mil/sec. with retention of structural integrity was observed employing Arcocel 163 propellant (6500° F, aluminized) at 900 psi. Author

N63-11509 National Aeronautics and Space Administration, Washington, D.C.

ROCKET PROPULSION

Walter T. Olson, Donald L. Nored, Edward W. Otto, Melvin J. Hartmann, Calvin L. Ball, Gerald Morrell, Richard J. Priem, Edmund R. Jonash, William A. Tomazic, John C. Sanders, and Leon M. Wenzel 1962 55 p 188 refs Papers presented at Session M of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-19) GPO:

CONTENTS:

1. INTRODUCTION Walter T. Olson (NASA. Lewis Research Center) 4 p 9 refs
2. FLUID PHYSICS OF LIQUID PROPELLANTS Donald L. Nored and Edward W. Otto (NASA. Lewis Research Center) 16 p 117 refs
3. NEW PROBLEMS ENCOUNTERED WITH PUMPS AND TURBINES Melvin J. Hartmann and Calvin L. Ball (NASA. Lewis Research Center) 13 p 22 refs
4. RECENT ASPECTS OF ROCKET COMBUSTION RESEARCH Gerald Morrell and Richard J. Priem (NASA. Lewis Research Center) 6 p 14 refs
5. CURRENT RESEARCH AND DEVELOPMENT ON THRUST CHAMBERS Edmund R. Jonash and William A. Tomazic (NASA. Lewis Research Center) 10 p 23 refs
6. DYNAMICS AND CONTROL OF CHEMICAL ROCKETS John C. Sanders and Leon M. Wenzel (NASA. Lewis Research Center) 4 p 3 refs
7. CONCLUDING REMARKS Walter T. Olson (NASA. Lewis Research Center) 1 p

N63-11510 National Aeronautics and Space Administration, Washington, D. C.

NUCLEAR ROCKET PROPULSION

David S. Gabriel, Frank E. Rom, Robert G. Ragsdale, Donald Bogart, Edward Lantz, Herman H. Ellerbrock, John N. B. Livingood, David M. Straight, John C. Sanders, Herbert J. Heppler, Jr., and Clint E. Hart 1962 62 p 79 refs Papers presented at Session N of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-20) GPO:

CONTENTS:

1. INTRODUCTION David S. Gabriel (NASA. Lewis Research Center) 3 p
2. ADVANCED CONCEPTS FOR NUCLEAR ROCKET PROPULSION F. E. Rom and R. G. Ragsdale (NASA. Lewis Research Center) 13 p 43 refs
3. NUCLEAR PHYSICS OF SOLID-CORE-GAS-COOLED ROCKET PROPULSION REACTORS D. Bogart and E. Lantz (NASA. Lewis Research Center) 9 p 3 refs
4. FLUID-FLOW AND HEAT-TRANSFER PROBLEMS IN NUCLEAR ROCKETS H. H. Ellerbrock, J. N. B. Livingood, and D. M. Straight (NASA. Lewis Research Center) 30 p 31 refs
5. PROBLEMS IN DYNAMICS AND CONTROL OF NUCLEAR ROCKETS J. C. Sanders, H. J. Heppler, Jr., and C. E. Hart (NASA. Lewis Research Center) 6 p 2 refs

N63-11512 National Aeronautics and Space Administration, Washington, D. C.

ELECTRIC PROPULSION FOR SPACECRAFT

Wolfgang E. Moeckel, Seymour Lieblein, John R. Jack, George R. Seikel, Warren D. Rayle, and Edmund E. Callaghan 1962 37 p 49 refs Papers presented at Session P of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-22) GPO:

CONTENTS:

1. INTRODUCTION W. E. Moeckel (NASA. Lewis Research Center) 3 p
2. SPECIAL REQUIREMENTS ON POWER GENERATION SYSTEMS FOR ELECTRIC PROPULSION S. Lieblein (NASA. Lewis Research Center) 10 p 7 refs
3. GENERATION OF THRUST—ELECTROTHERMAL THRUSTORS J. R. Jack (NASA. Lewis Research Center) 4 p 3 refs
4. GENERATION OF THRUST—ELECTROMAGNETIC THRUSTORS G. R. Seikel (NASA. Lewis Research Center) 6 p 25 refs
5. GENERATION OF THRUST—ELECTROSTATIC THRUSTORS W. D. Rayle (NASA. Lewis Research Center) 6 p 9 refs
6. ADVANCED CONCEPTS E. E. Callaghan (NASA. Lewis Research Center) 7 p 5 refs

28 SPACE RADIATION

Includes: cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts.

For related information see: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N63-11015 Physikalisch-Meteorologisches Observatorium, Davos (Switzerland)

COMPARISON OF MEASURED AND THEORETICAL VALUES OF THE SPECTRAL INTENSITY OF ULTRAVIOLET SKY RADIATION Technical Note No. 1

Paul Bener Sept. 1962 53 p 14 refs
(Contract AF 61(052)-618)
(AFCRL-62-1115)

The results of 99 records of the spectral intensity of ultraviolet sky radiation from zones above 20° elevation and relating to practically cloudless sky are compared with the corresponding theoretical intensity. The latter is computed by numerical integration from the values of sky brightness published by Z.Sekera et al. for a Rayleigh atmosphere. Johnson's smoothed values of the extraterrestrial solar intensity are furthermore applied for the computation. No influence of turbidity and absorption by atmospheric ozone is considered and the comparison is therefore limited to wavelength $\geq$ 330 mμ. Results: The measured intensity is lower and its trend with wavelength less inclined than expected according to the theory. The deviations amount to 32% at 330 mμ and decrease to 4% at 410 mμ in the average over the interval $15° \leq h \leq 60°$ of solar altitude. The curves representing the measured and computed intensity on a relative scale as a function of solar altitude agree well in their trend in the case of winter conditions, whereas more or less systematic deviations of minor magnitude are found for summer conditions. Author

N63-11121 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THERMAL RADIATION INCIDENT ON AN EARTH SATELLITE

Frank W. Swalley Washington, NASA, Dec. 1962 73 p 8 refs
(NASA TN D-1524) OTS: $2.00

Equations have been derived, using vector analysis, which predict the incident energy at any given point on an earth satellite. The derivation is based on a nonspinning satellite and extended to include spinning vehicles. The satellite was assumed to be oriented in any one of three ways—toward the sun, toward the earth, and tangent to the flight path at perigee. The amount of energy received depends upon the intensity of the radiation and the view factor between the object and source. The view factor equations are applicable to any mathematically describable shape. To determine the length of exposure to the sun, simple relations have been developed which predict the ingress and egress points of the earth's shadow. The solution to the equations was programed in a general manner on an IBM 7090. The input data required consisted of parameters to specify the orbit and an equation to describe the surface of the satellite. As an illustration, a cylindrical satellite with hemispherical ends was chosen. The view factor equations were derived and numerically integrated, and the incident energy was calculated for an arbitrarily selected orbit. The results indicated that spinning reduces the peak heat fluxes in all cases, and the minimum incident energy occurred when the vehicle was oriented toward the sun. The methods outlined in this report are applicable to satellites of other celestial bodies also. The only additional information required is a knowledge of the position of the sun and the orbital plane relative to the body.
Author

N63-11303 Minnesota U. School of Physics, Minneapolis
OBSERVATION OF THE VAN ALLEN RADIATION REGIONS DURING AUGUST AND SEPTEMBER, 1959. 4. THE OUTER-ZONE ELECTRONS
R. L. Arnoldy, R. A. Hoffman, and J. R. Winckler Repr. from J. Geophys. Research, v. 67, no. 7, July 1962 p 2595-2612 20 refs
(NASA Contract NASw-56)
(CR-51)

A study is reported of the data from the radiation detectors aboard the Explorer VI earth satellite (1959δ_1, launched August 7, 1959) as the spacecraft passed through the outer zone during a period when the count rate time variations and the geomagnetic activity were low. The radiation detectors aboard the satellite were an ionization chamber, a Geiger counter, a proportional counter telescope, and a scintillator. Extensive calibrations were made to determine the response of these detectors to monoenergetic electrons when inside a spare payload. In using these calibrations and fitting assumed power-law spectra of electrons to the data, it is seen that the spectrum is flat and must extend to several Mev at the small ranges, with the ion chamber and Geiger counter responses there due primarily to direct electron detection. The intensity of the energetic electrons is shown to decrease with increasing range as the spectra steepen and the radiation softens, resulting in an increasing contribution of bremsstrahlung to the rates of the chamber and Geiger counter. Any attempt to utilize the bremsstrahlung response of the Explorer VI detectors to determine fluxes is useless if an appreciable portion of their counting rate is produced by direct energetic particles. The spectral shape of the outer zone as suggested by this analysis allows us to interpret the minimum observed in the Geiger counter rate at an equatorial geocentric range of 19,000 km as having spectral-detector origin rather than as representing the removal of radiation by an anomaly in the earth's magnetic field. This analysis is only capable of fitting trial spectra to the data; the procedure does not eliminate the possibility of more complex spectra existing in the outer zone which would lead to different conclusions about the nature of the trapped radiation.
Author

N63-11489 Directorate of Research Analyses, Holloman AFB, N. Mex.
STELLAR SIMULATOR Technical Report
William F. Chambers (Duke U.) Dec. 1962 19 p
(AFOSR/DRA-62-22)

This report shows the feasibility of a system that will reproduce the black-body radiation spectrum of any star by forming the spectrum of a source, choosing the appropriate portions of the formed spectrum, and recombining the chosen portions into white light.
Author

29 SPACE SCIENCES

Includes: space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories.

For space biology see: 16 Life Sciences.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N63-11017 Manchester Coll. of Science and Tech. (Gt. Brit.)
LABORATORY SIMULATION OF LUNAR LUMINESCENCE Annual Summary Report No. 2
J. E. Geake, M. D. Lumb, and J. Derham Mar. 1962 7 p
(Grant AF-EOAR 61(052)-379)
(AFCRL-62-1099)

Instrumentation for laboratory simulation of lunar luminescence is practically completed, and the luminescence of some tektite and meteoric samples has been investigated. The grating monochromator has been completed and calibrated, and the equipment for ultraviolet and proton excitation has been designed so that the luminescence excited by UV and protons can be investigated one after the other with the sample in the same place. A few tektite and meteoric samples have been scanned with this equipment; also, arrangements have been made to use the large collection of meteoric material in the British Museum.
M.P.G.

N63-11018 Manchester U. (Gt. Brit.)
RESEARCH STUDY AND DEVELOPMENT OF 1 METRE-MIRROR FOR MOON TRACKING AND PHOTOGRAPHY Annual Summary Report No. 2
Zdeněk Kopal Mar. 1962 11 p
(Contract AF 61(052)-400)
(AFCRL-62-1100)

The optics for the 43-inch telescope, ordered the previous year, was delivered up to specifications and installed at the Observatoire du Pic-du-Midi in preliminary mounting in November 1961. Extensive optical tests of the 43-inch mirror in the factory at Newcastle and in its cell on Pic-du-Midi—both visual and photographic—have revealed the optical surface to be correct within $\pm \lambda/20$ over 90% of its effective arc; slightly larger deviations have been encountered only within the last 7-cms. of its free aperture. The first photographs of the Moon, secured with the aid of this mirror in a f/15 Cassegrain combination immediately after the end of the period covered by this report, are of excellent quality and augur well for the future.
Author

N63-11019 Manchester U. (Gt. Brit.)
SPECTROPHOTOMETRIC STUDY OF THE LUNAR SURFACE Annual Summary Report No. 2
Zdeněk Kopal Mar. 1962 12 p 2 refs
(Contract AF 61(052)-378)
(AFCRL-62-1096)

The instruments designed for the study of lunar luminescence as well as for the measurement of the polarization of moonlight during the period covered by the last year's Annual Summary Report have been built in our laboratories at the University of Manchester, and their field use commenced both at the 50-inch reflector of Asiago Observatory of the University of Padua and the 15-inch refractor of the Wilfred Hall Observatory at Preston, Lancashire.

Preliminary results of the reduction of observations do disclose the presence of an appreciable luminescent component in moonlight, amounting to a few percent of the total. There is, moreover, evidence on hand (though not yet definitive) that the amount of luminescence fluctuates both with the time and in frequency; but it will be the task of further observations planned for the period immediately following that covered by this report, to establish this with final validity. Author

N63-11127 Armour Research Foundation, Chicago, Ill.

LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, August 15 to November 15, 1962

Charles A. Hagen and E. J. Hawrylewicz [1962] 28 p 7 refs (NASA Contract NASr-22)

(ARF-3194-7) OTS: $2.60 ph, $1.04 mf

The objective of this phase of the program is to study the effect of a simulated Martian environment on the survival of terrestrial microorganisms. During the period covered by this report, the following studies were conducted on a strain of *Bacillus* under simulated Martian conditions: (1) survival, (2) adaptation, and (3) effect of culture age on survival. Additional experiments initiated included (1) the effect of the Martian environment on the native flora of California desert soil samples and (2) the growth and survival of a strain of *Bacillus* in the Martian environment as a function of moisture and organic medium added to Martian soil. Author

N63-11138 National Aeronautics and Space Administration, Washington, D.C.

SPACE SCIENCE—EARTH, SUN, AND STARS

Homer E. Newell *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 35-47 (See N63-11137 03-01)

This paper on space science of the Earth, Sun, and Stars covers the following: the relationship between the Earth and Sun; study of stars and galaxies; light and medium launch vehicles for space exploration; NASA probes and satellites; radiation belt studies; gamma ray astronomy; geophysics and solar physics; polar orbiting geophysical satellite topside sounder; orbiting solar observatory; eccentric orbiting geophysical observatories; astronomy; and orbiting astronomical observatory. J.R.C.

N63-11139 National Space Administration, Washington, D.C.

SPACE SCIENCE—MOON AND PLANETS

Edgar M. Cortright *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 49-58 (See N63-11137 03-01)

This paper reviews the most active projects for the exploration of the Moon, Mars, and Venus. The projects for unmanned exploration include projects Pioneer, Ranger, Mariner, and Surveyor. J.R.C.

N63-11212 National Aeronautics and Space Administration, Washington, D.C.

RESULTS OF OBSERVATIONS OF MARS IN THE USSR DURING THE GREAT OPPOSITION OF 1956

G. A. Tikhov et al Dec. 1962 203 p 99 refs Transl. of articles from the book "Rezul'taty Nablyudeniy Marsa vo Vremya Velikogo Protivostoyaniya 1956 g. v SSSR" Moscow, USSR Acad. of Sci. Pub. House, 1959

(NASA-TT-F-93)

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7. SOME THOUGHTS ON THE STATE OF THE ATMOSPHERE OF MARS N. N. Sytinskaya p 167-174 17 refs
8. VISUAL OBSERVATIONS OF MARS DURING THE GREAT OPPOSITION IN 1956 V. A. Bronshten p 175-193 11 refs
9. PHOTOGRAPHIC PHOTOMETRY OF THE LIGHT REGION OF ARGYRE ON MARS LATE IN AUGUST 1956 V. A. Bronshten and O. V. Dluzhnevskaya p 194-201 7 refs

N63-11252 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE EXISTENCE OF PERIODIC SOLUTIONS PASSING NEAR BOTH MASSES OF THE RESTRICTED THREE BODY PROBLEM

Richard F. Arenstorf N. Y., Am. Rocket Soc. [1962] 5 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2604-62) ARS: $0.50 members, $1.00 nonmembers

There exist in the Restricted Three-Body Problem with small mass ratio, one-parametric families of synodically closed solution curves, which are near rotating Keplerian ellipses with arbitrary rational sidereal frequencies and appropriate positive eccentricities. By suitable selection of the parameter values, these periodic solutions can be made to come close to both attracting bodies. The practical significance of this for astronautics becomes apparent, if one considers operating spacecrafts along such paths in the Earth-Sun or Moon-Earth systems. Author

N63-11256 Space Technology Labs., Inc., Redondo Beach, Calif.

THE ORBIT OF EXPLORER VI—A TEST OF THE DYNAMIC MODEL ATMOSPHERES

Kenneth Moe N. Y., Am. Rocket Soc. [1962] 5 p 11 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(Contract NAS5-1246)

(ARS Paper-2622-62) ARS: $0.50 members, $1.00 nonmembers

This paper describes briefly a new method for determining the definitive orbit of a satellite which is significantly affected by drag, and uses the EXPLORER VI orbit, obtained by this method, to test several of the proposed dynamic model atmospheres. Author

N63-11257 International Business Machines Corp. Federal Systems Div., Bethesda, Md.

REAL TIME APPLICATIONS OF CELESTIAL MECHANICS IN THE NASA GODDARD SPACE FLIGHT CENTER'S MERCURY SYSTEM

H. L. Norman and E. H. Weiss N. Y., Am. Rocket Soc. [1962] 13 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2623-62) ARS: $0.50 members, $1.00 nonmembers

This paper discusses some real time applications of celestial mechanics in the NASA Goddard Space Flight Center's Mercury System; it takes up the Launch Phase and describes the Short Arc Orbit Determination Program which utilizes the Bermuda high-speed radar immediately after insertion to obtain a current set of orbit elements until a GO, NO-GO decision is made. There follows discussion of the Orbit Element Predictor Program which is used to extrapolate elliptically a set of orbit elements to a new time and the Impact Predictor Program which extrapolates a set of orbital elements at

450,000 feet above the earth to an impact at 60,000 feet above the earth to an impact at 60,000 feet above the earth. The orbit phase is discussed as well as the question of which stations and how many observations per station are to be used in the differential corrections routine. The editing feature of the differential corrections routine is taken up next and finally the automatic acceptance-rejection criteria are discussed. Author

N63-11258 RAND Corp., Santa Monica, Calif.

A SET OF TWO-BODY ORBITAL PARAMETERS USEFUL FOR NEARLY CIRCULAR ORBITS AND SOME RELATED EQUATIONS

F. T. Smith N. Y., Am. Rocket Soc. [1962] 16 p 7 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2625-62) ARS: $0.50 members, $1.00 nonmembers

This report describes a set of two-body orbital parameters useful for nearly circular orbits and for orbits whose inclination to the reference plane is very small. Various equations involving this set of orbital parameters are presented. These equations are useful for the computation of ephemerides, orbital parameters from rectangular components of position and velocity at a specified epoch, differential correction processes, perturbation computations, and orbit transfer computations. Author

N63-11259 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LAUNCH WINDOW STUDIES EMPLOYING VARIATIONAL CALCULUS TO DETERMINE OPTIMUM THREE DIMENSIONAL TRAJECTORIES LEADING TO INJECTION INTO A SPACE-FIXED CIRCULAR ORBIT

W. E. Miner and Robert Silber N. Y., Am. Rocket Soc. [1962] 8 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper 2626-62) ARS: $0.50 members, $1.00 nonmembers

The problem of establishing a circular orbit in a prespecified space-fixed plane is considered with the viewpoint of establishing performance penalties resulting from deviations in launch time from optimum launch time. The purpose is to obtain, as a function of allowable performance loss, a *launch window*, i.e., a certain time interval about the optimum launch time within which launch may occur resulting in no more than the allowable performance loss. With the aid of the calculus of variations, trajectories resulting from nonoptimum launch times are made optimum for that launch time. Hence, the performance figure which results is strictly a function of the launch time. The orbital plane of basic interest is that of minimum inclination obtainable by a two-dimensional injection from Cape Canaveral. Variations of a few degrees below this value are considered to determine the minimal expense for the plane changes. Injection into planes of lower inclination are accomplished with three-dimensional trajectories. The analysis is performed using a three-dimensional calculus of variations flight deck for flight out of the atmosphere, resulting in optimum maneuvers both in and out of plane. This system and its application are discussed. Author

N63-11270 Hughes Research Labs., Malibu, Calif.

ION PROPULSION FOR THE CONTROL OF STATIONARY SATELLITES

Jerome H. Molitor N. Y., Am. Rocket Soc. [1962] 27 p 6 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2666-62) ARS: $0.50 members, $1.00 nonmembers

This paper reviews the major forces (e.g., earth's triaxiality, solar and lunar attraction, solar pressure, etc.) which tend either to perturb the satellite orbit or modify its orientation. The mission constraints which affect the engine system design, such as velocity increments associated with vernier orbit corrections, required thrusting directions, and the magnitude of disturbance torques, are presented. An evaluation is made of the tradeoffs between such critical parameters as attitude and station keeping accuracy, average power utilization, duty cycle, length of thrusting interval, and satellite mass and moments of inertia. In addition, a preliminary design of an ion engine attitude control and station keeping system is given. Such system parameters as power level, thrust level, specific impulse, weight, etc., are specified. Author

N63-11272 National Aeronautics and Space Administration, Washinton, D.C.

THE IMPACT OF THE LUNAR ORBIT RENDEZVOUS CONCEPT OF THE TEST, OPERATIONS AND SUPPORT PROBLEMS OF LUNAR EXPLORATION

James E. Sloan N. Y., Am. Rocket Soc. [1962] 13 p 1 ref Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2686-62) ARS: $0.50 members, $1.00 nonmembers

In order to achieve maximum assurance of success in the early lunar landing mission of Apollo, a program-wide test and checkout effort has been organized by NASA to pull together the entire chain of tests, from manufacture to lunar surface prelaunch checkout. It is concluded that the choice of lunar orbit rendezvous rather than earth orbit rendezvous does not significantly change this program nor impose increased demands on the prelaunch or in-flight checkout and test equipments or operations required of the crew. The possible addition of a lunar logistics system to the program would increase the possible stay time on the moon and provide redundant support for the lunar exploration party for either the lunar-orbit-rendezvous or earth-orbit-rendezvous mode. Author

N63-11274 Bell Aerosystems Co., Buffalo, N.Y.

PROBLEMS OF EARTH SIMULATION OF MANNED LUNAR LANDING

Kenneth L. Levin and Roland Decrevel N. Y., Am. Rocket Soc. [1962] 12 p 4 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(NASA Contract NAS4-174)

(ARS Paper-2691-62) ARS: $0.50 members, $1.00 nonmembers

The lunar exploration program which is currently being implemented will encounter environments which are foreign to our presently developed knowledge of flight operations. For conventional air breathing aircraft, a backlog of sixty years experience in manned landing has established the adequacy of basic engineering criteria. In the case of lunar landing, no such previous effort exists and a program of research and testing is urgently needed to develop the necessary criteria and requirements on which the Apollo design can be based. Flight simulation is a basic tool to provide design data and training which could otherwise only be obtained by flight of the actual full-scale system. Characteristics of the lunar environment basic to the design of a research simulator are discussed. Problems which require early flight research are presented. The problems of flying a prototype of a lunar vehicle on earth are identified. A special and unique research vehicle capable of being flown within the earth's atmosphere has been designed to provide the characteristics of a lunar vehicle. A detailed description, drawings, and weight and performance summary are presented. Author

N63-11302 California U., Berkeley, Space Sciences Lab.

BIOCHEMICAL ACTIVITIES OF TERRESTRIAL MICROORGANISMS IN SIMULATED PLANETARY ENVIRONMENTS Semiannual Status Report

Carl Sagan and Stanley Scher Aug. 1, 1962 15 p

(NASA Grant NsG-126-61)

(*Its* Ser. 3, Issue 13) OTS: $1.60 ph, $0.80 mf

Studies of the biochemical activities of terrestrial microorganisms under simulated planetary conditions have continued, and results are

reported in both defining the environmental conditions of Mars, Venus, and Jupiter and in determining the metabolic, ecologic, and genetic processes in microorganisms under these conditions. The denitrification and photosynthetic processes in *Rhodopseudomonas* and *Rhodospirillum* were investigated under anerobic conditions. The effect of environmental factors on the cytoplasmic DNA synthesis associated with chloroplast inheritance in *Euglena gracilis* were studied as well as the effect of simulated Martian environment on microorganisms in soil samples collected in the Sierras where extremes of temperature are normal. Reports on the physics of planets, on the structure of the lower atmosphere of Venus, and on observations of the Jovian Red Spot were presented. Abstracts of papers prepared during this period are appended. M.P.G.

N63-11407 RAND Corp., Santa Monica, Calif.

STUDIES OF THE PHYSICAL PROPERTIES OF THE MOON AND PLANETS Quarterly Technical Progress Report (8) [April 1, 1962 to June 30, 1962]

July 1962 12 p 4 refs

(NASA Contract NAS7-100; Contract JPL N-33561)

(AR-26-JPL) OTS: $1.60 ph, $0.80 mf

Studies of the physical properties of the moon and planets are reported. These include the following: planetary atmospheres, radiative transfer, atmospheric scattering, an isostatic model of the moon, cosmogonic studies, optical tracking of deep-space probes, and planetary orbiters. R.C.M.

N63-11415 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.

EARLY SOLAR EVOLUTION

D. Ezer and A. G. W. Cameron Repr. from Sky and Telescope, v. 24, no. 6, Dec. 1962 p 1-4

Early solar evolution was investigated. Boundary conditions for the star were derived from four differential equations describing the physical properties of the star throughout its interior. A departure from the standard procedure used in this type of study was the construction of new models based on the assumption of a homologous contraction. Results are shown in a Hertzsprung-Russel diagram, and were in full confirmation with Hayashi's suggestion that the early sun was fully convective and highly luminous. I.v.L.

N63-11501 National Aeronautics and Space Administration, Washington, D.C.

PROCEEDINGS OF THE NASA-UNIVERSITY CONFERENCE ON THE SCIENCE AND TECHNOLOGY OF SPACE EXPLORATION, VOLUME I, CHICAGO, NOVEMBER 1-3, 1962

Homer E. Newell et al Dec. 1962 412 p 499 refs For Vol. II see N63-11502 03-29

(NASA-SP-11, Vol I) GPO: $2.50

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N63-11502 National Aeronautics and Space Administration, Washington, D.C.

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Walter T. Olson et al Dec. 1962 522 p 805 refs For Vol. I see N63-11501 03-29 Cumulations of papers will be issued as indicated below

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58. RELATIONS BETWEEN AERODYNAMICS AND MAGNETOHYDRODYNAMICS Adolf Busemann (NASA. Langley Res. Center) p 305-312 2 refs To be issued as part of NASA-SP-25 (See N63-11515 03-24)
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60. THE ELECTRIC DRAG FORCES ON A SATELLITE IN THE EARTH'S UPPER ATMOSPHERE George P. Wood (NASA. Langley Res. Center) p 337-345 10 refs To be issued as part of NASA-SP-25 (See N63-11515 03-24)
61. PLASMA FREQUENCY AND RADIO ATTENUATION Paul W. Huber and Clifford H. Nelson (NASA. Langley Res. Center) p 347-360 35 refs To be issued as part of NASA-SP-25 (See N63-11515 03-24)
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66. GENERATION OF MAGNETIC FIELDS BY FLUX COMPRESSION IN SUPERCONDUCTORS Daniel D. Elleman (JPL) p 429-435 13 refs To be issued as part of NASA-SP-26 (See N63-11516 03-23)

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67. SPACE ENVIRONMENT AND ITS EFFECTS ON MATERIALS Don D. Davis, Jr. (NASA. Langley Res. Center) p 439-449 25 refs To be issued as part of NASA-SP-27 (See N63-11517 03-19)
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69. ABLATION MATERIALS FOR ATMOSPHERIC ENTRY Leonard Roberts (NASA. Langley Res. Center) p 461-468 30 refs To be issued as part of NASA-SP-27 (See N63-11517 03-19)
70. FLOW AND FRACTURE PROBLEMS IN AEROSPACE VEHICLES Richard H. Kemp (NASA. Lewis Res. Center) p 469-476 5 refs To be issued as part of NASA-SP-27 (See N63-11517 03-19)
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SESSION V: STRUCTURES

72. RESEARCH, DESIGN CONSIDERATIONS, AND TECHNOLOGICAL PROBLEMS OF STRUCTURES FOR LAUNCH VEHICLES Harry L. Runyan and Robert W. Leonard (NASA. Langley Res. Center) p 487-498 15 refs To be issued as part of NASA-SP-28 (See N63-11518 03-34)
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74. RESEARCH, DESIGN CONSIDERATIONS, AND TECHNOLOGICAL PROBLEMS OF STRUCTURES FOR PLANETARY ENTRY VEHICLES Roger A. Anderson (NASA. Langley Res. Center) p 511-520 25 refs To be issued as part of NASA-SP-28 (See N63-11518 03-34)
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N63-11504 National Aeronautics and Space Administration, Washington, D.C.

LUNAR AND PLANETARY SCIENCES IN SPACE EXPLORATION

Walter K. Victor, Manfred Eimer, Conway Snyder, Hugh R. Anderson, Marcia Neugebauer, Edward J. Smith, Ray L. Newburn, Jr., Robert C. Speed, James E. Conel, Robert L. Kovach, and Alden A. Loomis 1962 84 p 160 refs Papers presented at Sessions E. and H of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11501 03-29) (NASA-SP-14) GPO:

CONTENTS:

1. RADAR ASTRONOMY W. K. Victor (JPL) 9 p 7 refs
2. THE SCIENTIFIC EXPLORATION OF DEEP SPACE Eimer (JPL) 7 p 3 refs
3. INTERPLANETARY SPACE PHYSICS C. Snyder, H. R. Anderson, M. Neugebauer, and E. J. Smith (JPL) 33 p 70 refs
4. PLANETARY ASTROPHYSICS AND THE EXPLORATION OF THE SOLAR SYSTEM E. L. Newburn, Jr. (JPL) 9 p 30 refs

5. GEOLOGICAL EXPLORATION OF THE MOON AND PLANETS R. C. Speed, J. E. Conel, R. L. Kovach, and A. A. Loomis (JPL) 23 p 50 refs

30 SPACE VEHICLES

Includes: launch vehicle—spacecraft combinations; operating problems; and stability and control.

For manned space capsules, satellites, and space probes see: 32 Space Vehicles (Spacecraft).

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For related information see: 04 Aircraft; 08 Communication; and 22 Navigation and Guidance.

N63-11004 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METEOROID HAZARD TO SPACE VEHICLES IN ORBIT NEAR THE EARTH: A FUNCTIONAL INTERPRETATION OF THE INFORMATION FOR DESIGN AND OPERATIONS DECISIONS

Charles C. Dalton Washington, NASA, Dec. 1962 88 p 51 refs (NASA TM X-789)

In this survey and analysis of the meteoroid hazard to space vehicles in near-earth orbits, operations research methods have been used to establish and to propagate confidence levels with respect to all of the pertinent functional relations involving design and operations parameters. The graphically illustrated results show that the wall thickness, necessary for specified operational results, must be increased by a factor 2.00 to increase confidence from 50 percent to 75 percent, and that this factor would still be 1.81 if there were no uncertainty with respect to hypervelocity impact phenomena. Both the median values and the upper and lower fiducial limits for the 50 percent confidence interval for the mean flux, closing velocity relative to the earth, closing velocity relative to a vehicle in a near-earth orbit, density (specific gravity), just-puncturable thickness of hard aluminum, and just-puncturable thickness of hard stainless steel are shown for values of meteoroid mass between 10 grams and 100 micro-micrograms. Author

N63-11069 DODCO, Inc., Blawenburg, N.J.

FLIGHT CONTROL OF HYPERSONIC VEHICLES WITH A TEMPERATURE SENSING LOOP

Daniel O. Dommasch *In* Aeronautical Systems Div., Air Force System Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 468-497 5 refs (See N63-11058 03-01)

The concepts of optimum control theory are applied to the general problem of controlling the descent of a hypersonic reentry system in an incompletely defined environment. It is shown that the effects of thermoaeroelastic deformations and other variables which alter the vehicles' characteristics as well as the uncertainties arising from undefined environmental conditions can readily be handled by an optimum adaptive macro-micro controller. Because of the magnitude of the changes to be expected in atmospheric characteristics from point to point about the earth and from day to day in a time sense, it is concluded that preprogramed descents whose success is predicated on the assumption that a statistical standard atmosphere will be encountered are likely to cause destruction of a reentry vehicle of failure to perform an assigned mission. Author

N63-11070 Aeronautical Systems Div. Flight Control Lab., Wright-Patterson AFB, Ohio

FUTURE CONTROL SYSTEMS FOR VEHICLES WITH LARGE AEROTHERMOELASTIC EFFECTS

P. C. Gregory and H. M. Davis *In* Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 498-527 24 refs (See N63-11058 03-01)

The fundamental concept of adaptive-control system design practice is described and illustrated. A discussion shows how such systems function to provide constant dynamic performance in spite of changes in control gain and vehicle dynamics caused by such things as aerothermoelasticity. Applications are projected for using advanced techniques to stabilize and control the vehicle and its structural modes with a reliable increase of system performance. A summary of adaptive-control techniques is presented. Author

N63-11122 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATOR STUDY OF AN ACTIVE CONTROL SYSTEM FOR A SPINNING BODY

James J. Adams Washington, NASA, Dec. 1962 21 p 1 ref (NASA TN D-1515) OTS: $0.50

Model simulator tests of an automatic precession-wheel damping controller for a spinning vehicle have been made by using an inertial simulator mounted on an air bearing. The results show that this type of controller provides very good wobble damping and also provides the torque necessary to keep the vehicle spinning on its body axis of symmetry in the presence of a shift in the principal axes. The tests were made with the simulator in disk-, sphere-, and rod-shaped configurations. Author

N63-11126 Martin-Marietta Corp. Space Systems Div., Baltimore, Md.

PRETEST INFORMATION, 7½ PERCENT 624A GROUND WIND AND WIND INDUCED OSCILLATION TEST, LANGLEY RESEARCH CENTER

Nov. 1962 43 p 6 refs
(Contract AF 04(695)-54)
(ER-12737)

A study is made of the effects loads created by ground winds have on the design of large boosters such as the 624A. Tests will be performed on a 7.5% model of the 624A vehicle in the 16-ft transonic wind tunnel. The loads are composed of both static and oscillatory components. The oscillatory loads arise from the phenomena of vortex shedding from bodies when subjected to normal air flow. Because the oscillatory loads have been found to be dependent to a large extent on booster nose configuration, a conical, bulbous and Dyna-Soar payload configuration will be evaluated. The umbilical towers associated with the various conditions will also be included to permit evaluating the effects of these obstructions on the resulting air loads. J.R.C.

N63-11140 National Aeronautics and Space Administration, Washington, D.C.

SPACE VEHICLE RESEARCH

Milton B. Ames, Jr. *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 59-70 (See N63-11137 03-01)

This space-vehicle research review covers: launch and exit from atmosphere of spacecraft, launch-vehicle system dynamics, chemical propulsion, launch vehicle recovery, and reentry vehicle technology. J.R.C.

N63-11143 National Aeronautics and Space Administration, Washington, D.C.

NASA COMMUNICATIONS SATELLITE PROGRAM

Leonard Jaffe *In its* Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 103-114 (See N63-11137 03-01)

This paper reviews the NASA communications satellite program. The three major types of communications satellite systems, which offer sufficient promise to warrant continued detailed investigation, are those that use the following: low- or intermediate-altitude passive reflectors, low- or intermediate-altitude active repeaters, or high-altitude synchronous active repeaters. The properties of the sphere as a communications reflector are being evaluated in flight tests of Echo I and Echo II. J.R.C.

N63-11253 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMMUNICATIONS SATELLITE PROGRAM

Robert J. Mackey, Jr. N.Y., Am. Rocket Society [1962] 28 p Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962

(ARS Paper-2617-62) ARS: $0.50 members, $1.00 nonmembers

The objectives of the NASA communications satellite program are to demonstrate the feasibility of both active and passive communications satellite techniques, to assist in developing an operational system as rapidly as possible, and to support the development and expansion of operational satellite systems. In the passive satellite program, Project Echo A-12 represents the effort to develop larger and much more rigid satellite than Echo 1, which demonstrated the feasibility of communications via spherical reflector satellites. In the active satellite program, Project Telstar launch and tracking was accomplished; Project Relay was designed to demonstrate the feasibility of low-altitude active communication satellite systems by assessing the quality of wideband television and telephony; and Project Syncom will provide experience in launching and operating a near-synchronous-orbit communications satellite system. The communications satellite program has also entailed a considerable cooperative effort with other Government agencies, industry, and foreign countries so that a variety of ground systems are available for experimentation which should lead to more sophisticated communication satellite systems. M.P.G.

N63-11321 Iowa State U., Iowa City

THE INJUN III SATELLITE

B. J. O'Brien, C. D. Laughlin, and D. A. Gurnett [1962] 64 p (NASA Grant NsG-233-62; Contract N9nor-93803)

(SUI-62-24) OTS: $6.60 ph, $2.12 mf

A brief and preliminary description of the Injun III geophysical research satellite outlines its general features and scientific aims prior to launch. It is intended to orbit the 105-pound payload at about 1000 km altitude at a 70° inclination as an independent satellite with a nominal lifetime of one year. The satellite is designed to study the properties of natural and artificial radiation zones, auroras and airglow, and VLF phenomena, and to study possible correlations of some of these phenomena. The satellite will be magnetically oriented. Author

N63-11409 Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio

A GENERAL THEORY AND ANALYSIS OF THE DYNAMIC STABILITY OF FLEXIBLE-BODIED MISSILES [Final] Technical Documentary Report [December 1960-May 1961]

Robert L. Swaim Oct. 1962 138 p 10 refs

(ASD-TDR-62-627)

This report presents a detailed and general derivation of the linear equations of motion for flexible-bodied missiles. In addition to the six rigid-body equations, modal equations are derived for an arbitrary number of elastic degrees of freedom about all three coordinate axes. By incorporating typical automatic control system servo-element equations, a closed-loop missile-autopilot system is formed. The dynamic response of this system is represented by a series of simultaneous, linear, variable-coefficient, ordinary differential equations. The dynamic stability of the system can be determined by making any desired number of point stability analyses along the missile trajectory. By making point analyses, the variable coefficients become constant coefficients for each time instant or point along the trajectory, and the differential equations are then amenable to Laplace transform techniques. The coefficients of the resulting stability determinant are tabulated in general form. Author

N63-11460 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NIMBUS SPACECRAFT SYSTEM

Rudolf Stampfl and Harry Press Repr. from Aerospace Eng., v. 21, no. 7, July 1962 p 16-28 3 refs

The objective of Project Nimbus is to provide a capability for continuous satellite observation for application to weather analyses and forecasting. Designed to meet this objective and now under construction, the spacecraft and related ground systems design are detailed. Basic measurements to be obtained include global television picture coverage of the daytime cloud cover and measurements of the earth's infrared radiation, the reflected radiation, and the earth's heat balance. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes: boosters; clustered rockets; and multistage rockets.

For propulsion engines see: 27 Propulsion.

For launch vehicle - spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-11051 RAND Corp., Santa Monica, Calif.

ON THE DYNAMICAL EFFECTS OF FUEL FLOW ON THE MOTION OF BOOST VEHICLES

Dominic G. B. Edelen Oct. 1962 47 p 9 refs

(NASA Contract NASr-21-(03))

(RM-3268-NASA) OTS: $4.60 ph, $1.61 mf

The problems of representing the dynamical state of a deformable boost vehicle are analyzed to determine the effects of fuel flow on stability. A variational principle is derived which encompasses the local vectorial equations of motion and allows the use of any convenient system of generalized coordinates as dynamical variables. With the aid of the variational principle, a detailed derivation of the governing equations of a rocket vehicle is given. The motion is assumed to be confined to the pitch plane. The vehicle is described in terms of verticle and horizontal translation, pitch, and bending deformations. Other dynamic variables, such as fuel slosh, control-element deflections, and internal degrees of freedom, can be included. It is shown that fuel motion can act as either a stabilizing or a destabilizing influence. The conclusion is drawn that fuel-flow effects must be included in any future analyses of boost vehicles. R.C.M.

N63-11147 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LAUNCH VEHICLES AND LAUNCH OPERATIONS

Wernher Von Braun *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 147-162 (See N63-11137 03-01)

This paper discusses the large space carrier vehicles: the ones that are being used and will be used in the future to undertake interplanetary investigations and to accomplish the manned spaceflight programs. This review of our large space carrier vehicles is limited to descriptions and capabilities and doesn't include operational employment. The vehicles discussed include the Atlas, Atlas-Centaur, Titan, and Saturn. J.R.C.

N63-11180 Lockheed Missiles and Space Co., Sunnyvale, Calif.
NASA/AGENA-B RANGER PROGRAM LAUNCH PAD DAMAGE REPORT FOR ATLAS 133D/AGENA-B 10205-6004 RANGER SPACECRAFT RA-4 COMPLEX 12, AMR
R. B. Hutchins Apr. 27, 1962 15 p
(Contract AF 04(647)-592)
(LMSC-271597; SSQ-592-T62-1)

This report covers the damage to the launch pad and Aerospace Ground Equipment (AGE) at Complex 12, AMR, resulting from the launch of Ranger Spacecraft RA-4/Agena-B Vehicle 6004/Atlas Booster 133D on 23 April 1962. A postlaunch inspection of Complex 12 and all AGE revealed that no major structural or electrical damage occurred. All damage occurring at the launch pad is listed. Preventive measures to minimize damage during future launches are discussed. Author

N63-11276 Minneapolis-Honeywell Regulator Co., Minn.
AN APPLICATION OF TIME OPTIMAL CONTROL TO A FLEXIBLE LAUNCH VEHICLE
F. B. Smith, Jr., and J. A. Lovingood (NASA. Marshall Space Flight Center) N.Y., Am. Rocket Soc. [1962] 9 p 9 refs Presented at the ARS 17th Annual Meeting and Space Flight Exposition, Los Angeles, Nov. 13-18, 1962
(NASA Contract NASr-27)
(ARS Paper-2694-62) ARS: $0.50 members, $1.00 nonmembers

A minimum response time criterion is used in the design of a pitch attitude controller for a flexible launch vehicle. The criterion is applied to a fourth-order model containing the primary dynamics of an assumed thirteenth-order vehicle. A collection of time-optimal, open loop trajectories is used to define the closed loop control law. Results of an analog simulation are presented which show that this control law properly applied to the flexible vehicle results in good control. Author

32 SPACE VEHICLES (SPACECRAFT)

Includes: manned space capsules; satellites; and space probes.

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For Launch vehicle—spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-11145 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECTS MERCURY AND GEMINI
Robert R. Gilruth *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 129-135 (See N63-11137 03-01)

Project Mercury has adequately demonstrated man's capability and use in spaceflight and has given initial solutions to basic space problems. Project Gemini is in the design and construction phase. It is planned to use the lessons learned in Mercury and to provide significant increases over Mercury in spaceflight duration and maneuverability. Gemini will provide flight experience and technical knowledge that will be applied to Apollo and to more advanced spaceflight missions. J.R.C.

N63-11146 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT APOLLO
George M. Low *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 137-145 (See N63-11137 03-01)

This paper on Project Apollo covers the three most promising methods to accomplish a manned lunar landing. These are: direct flight, earth orbit rendezvous, and lunar orbit rendezvous. Also, the Apollo spacecraft is described, along with many of its major features. A discussion of some of the most important reliability factors includes: soundness and simplicity of design; excellent quality in all component subsystems, and systems; intensive ground- and flight-test programs; adequate training and mission simulation for all involved in the operation; and use of man to enhance reliability wherever possible. J.R.C.

N63-11159 National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ASTRONAUT'S REPORT ON PROJECT MERCURY
John H. Glenn, Jr. *In* NASA. Proc. of the Second National Conf. on the Peaceful Uses of Space, Seattle, May 8-10, 1962 Nov. 1962 p 273-275 (See N63-11137 03-01)

This paper reviews some of the objectives of the Mercury-Atlas flight which include the following: evaluation of the performance of a manned spacecraft system in a three-orbit mission, evaluation of the effect of a space mission on the astronaut, and obtaining the astronaut's opinions on the operational suitability of the spacecraft and supporting systems for man's spaceflight. The results obtained in these opinion and performance areas enable engineers to design better vehicles and give us an idea of the directions our efforts should take in the future. J.R.C.

N63-11422 Lincoln Lab., Mass. Inst. of Tech., Lexington
TIME-OPTIMAL VELOCITY CONTROL OF A SPINNING SPACE BODY
Michael Athanassiades, Peter L. Falb, and Richard T. Lacoss Sept. 12, 1962 39 p 9 refs
(Supported by Army, Navy, and AF)
(MS-703)

The problem of minimum-time angular velocity control of a spinning space body, with a single axis of symmetry, is examined. The control thrusts are assumed bounded. Two-axis, gimballed, and single-axis control are considered. The optimal control law is derived for each method. Comparison of the response times indicates that gimballed control is best. Author

33 STRESSES AND LOADS

Includes: fatigue; vibration; flutter; and structural tests.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 34 Structural Design.

N63-11059 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROBLEMS AND DEVELOPMENTS IN AEROTHERMOELASTICITY

I. E. Garrick and Herbert J. Cunningham *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 12-60 44 refs (See N63-11058 03-01)

The paper aims first to delineate problem areas significant to various flight vehicles and missions, and to indicate the current technological background of significance for design and analysis. It is noted that both designing to live with thermal stresses and designing to avoid thermal stresses may lead to types of dynamic problems to be overcome. The second part consists of a selection of recent results and findings, both experimental and analytical, which show effects of high temperatures and of transient heating rates on vibration and flutter characteristics of lifting surfaces and panel coverings. Also included is mention of some useful experimental facilities. Author

N63-11060 Aeronca Mfg. Corp., Middletown, Ohio

PROGRESS IN AEROTHERMOELASTICITY OUTSIDE THE UNITED STATES

Peter A. Castruccio and Milton Rogers (AFOSR) *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 61-90 9 refs (See N63-11058 03-01)

A synthesis of the foreign unclassified literature in aerothermoelasticity is presented. The field of aerothermoelasticity is classified by salient subordinate disciplines, and the principal theoretical and experimental design and verification tools for each discipline are listed and briefly described. Within this framework of classification, essential characteristics of foreign efforts, particularly Soviet, as gleaned and deduced from the literature, are described and discussed. Author

N63-11061 Aeronautical Systems Div. Flight Dynamics Lab., Wright-Patterson AFB, Ohio

FUTURE DYNAMIC AEROTHERMOELASTIC CONSIDERATIONS FROM A VEHICLE REQUIREMENTS VIEWPOINT

Thor M. Snaring and Donald J. Ketter *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 91-119 11 refs (See N63-11058 03-01)

This paper is concerned with a discussion of dynamic aerothermoelasticity on the basis of estimated future system requirements. Aerothermoelastic problem areas are identified and discussed with regard to their possible scope and complexity. Limitations of current aerothermoelastic technology as well as potential research gaps resulting from future requirements are also discussed. The paper is generally aimed at dynamic aerothermoelastic phenomena; however, some static aerothermoelastic problem areas are indicated, and new phenomena peculiar to space dynamics are identified. Author

N63-11064 North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.

PREDICTION OF STIFFNESS AND VIBRATION CHARACTERISTICS OF TRUSSES, MULTI-STAGE CYLINDERS, AND CLUSTERED CYLINDERS

Francis C. S. Hung and Donald J. Stone *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 219-289 29 refs (See N63-11058 03-01)

A review has been made of past work in stiffness and vibration prediction methods for trusses, cylinders, conical shells, multistage cylinders, and clustered cylinders. A method of stiffness and vibration analysis of trusses with temperature gradients is presented. Several approaches for the solution of problems relating to clustered cylinders are also discussed. Since adequate knowledge of the behavior of boosters is necessary for sucessful space flight, recommendations are made for future research in analytical predictions and tests to substantiate these analyses. Author

N63-11065 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

A CONSIDERATION OF THE SIMILARITY REQUIREMENTS FOR AEROTHERMOELASTIC TESTS ON REDUCED SCALE MODELS

W. G. Molyneux *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 290-339 16 refs (See N63-11058 03-01)

The similarity requirements for model tests are established and different possibilities with regard to relaxations of these requirements are examined with the aim of devising an acceptable experimental technique for representative tests on models of reduced scale. It appears that the representation of heating effects must of necessity be rather crude, but may nevertheless be adequate for aerothermoelastic research. Test techniques that provide a reasonably close representation of flight conditions require tunnels with heated flow and with subsidiary radiant heat in the working section. Failing this, models can be constructed with an effective stiffness representative of heated conditions for tests in conventional facilities. Author

N63-11066 Giannini Controls Corp. Astromechanics Research Div., Berwyn, Pa.

FLIGHT CONTROL OF AEROTHERMOELASTICALLY AFFECTED VEHICLES

Melvin B. Zisfein *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 342-368 (See N63-11058 03-01)

This paper begins with a brief description of the aeroelastic interactions which can influence the stability and control of a flight vehicle. Next, some highlights of the past decade's flight control aerothermoelasticity research are presented, leading to a description of present capabilities. The paper concludes with a discussion of some future problem areas and suggestions for some of the research which will be required for future flight vehicle design. Author

N63-11068 Bell Aerosystems Co., Buffalo, N.Y.

NONLINEAR HYPERSONIC THERMOELASTIC STABILITY AND CONTROL DERIVATIVES

Vincent W. Donato, Joseph Padlog, and James R. Batt *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 407-467 23 refs (See N63-11058 03-01)

The effect of hypersonic aerodynamic nonlinearities on static aeroelastic equilibrium solutions and the concomitant stability and control derivatives are presented. The classical two-dimensional aeroelastic model is initially studied and the results extended to more complex three-dimensional aeroelastic phenomena. Methods for the solution of the nonlinear static aeroelastic interaction equations are derived, and expressions for the flexible to rigid ratio of lifting pressure, span loading, and three-dimensional lift curve slope are developed. Results of a sample problem are presented to illustrate use of the numerical methods derived and to display the effects of aerodynamic nonlinearities. Author

N63-11071 General Electric Co. Missile and Space Vehicle Dept., Philadelphia, Pa.

HEATING PROBLEMS OF ENTRY INTO PLANETARY ATMOSPHERES FROM SUPERCIRCULAR ORBITING VELOCITIES

Sinclaire M. Scala *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 530-592 60 refs (See N63-11058 03-01) (Partially supported by NASA Contract NASr-32)

A brief review is given of the influence of trajectory parameters on the severity of the environmental conditions to which a vehicle in a planetary atmosphere traveling at supercircular velocities will be exposed. The governing equations for the determination of heat transfer in partially ionized gases are presented and discussed. Currently available theoretical techniques of estimating the transport and thermodynamic properties of partially ionized gases are reviewed, and inadequacies are summarized. Available theories for predicting the convective (aerothermochemical) and radiative heat transfer at superorbital flight speeds are discussed, new theoretical and experimental results are given, and suggestions for needed future work are outlined. Some estimates are given of the anticipated thermal stress levels which will be encountered during lifting reentry from outer space. Finally, an integrated approach to the determination of the solution to the aerothermo-viscoelastic problem of supercircular flight is outlined. Author

N63-11073 Lockheed-California Co., Burbank

DETERMINATION OF HYPERSONIC AERODYNAMIC LOADS AND DERIVATIVES ON RE-ENTRY GLIDE VEHICLES

Frank S. Malvestuto, Jr. *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 641-677 4 refs (See N63-11058 03-01)

This paper presents a number of physical concepts pertaining to the reaction of inviscid flows to bodies moving at high speeds. A physical interpretation is given to the hypersonic similarity parameter. The total aerodynamic force on a body is delineated on the basis of this interpretation and upon a synthesis of the total force in terms of primary forces that control the reaction of the fluid. Within the framework of these concepts, formulas are presented for the calculation of the inviscid hypersonic pressures for vehicles composed of planar surfaces. Author

N63-11080 Martin Co., Baltimore, Md.

TRANSIENT STRUCTURAL PERFORMANCE UNDER AN INTERMITTENT LOAD-TEMPERATURE-TIME ENVIRONMENT

P. C. Huang *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 918-961 46 refs (See N63-11058 03-01) (Contracts AF 33(616)-6436 and AF 33(616)-6904)

This paper presents the analytical methods and computer solutions for various types of structural elements under the applications of load and temperature, which may vary intermittently with time. The time-dependent structural parameters such as stress, the corresponding deformation components, etc., can be calculated with the inclusion of temperature-dependent nonlinear mechanical properties of the material. Results of an extensive experimental correlation program are also shown for along flat plate of aluminum subjected to intermittent axial and bending loads at continually varying elevated temperatures. The correlation test was run at high temperatures for this material to yield approximately 1% strain with 34 hours. The maximum difference between theoretical and experimental deflection data was found to be within 10%. Author

N63-11165 Purdue U. School of Aeronautical and Engineering Sciences, Lafayette, Ind.

HORIZONTAL SLUMP OF A VISCOELASTIC HOLLOW CYLINDER CONTAINED IN A THIN ELASTIC SHELL

K. C. Valanis Oct. 1962 34 p 2 refs
(Contract AF 94(611)-8013)
(A&ES-62-6)

The problem of the horizontal slump of a viscoelastic cylinder contained in a thin flexible shell resting on a rigid plane is solved. The solution is within the scope of small deformations and classical shell theory. The viscoelastic stress-strain law is of the integral type, and it is used in its most general form. The solution is purely formal in as far as no numerical results are given. Author

N63-11166 Purdue U. School of Aeronautical and Engineering Sciences, Lafayette, Ind.

ERROR ANALYSIS OF APPROXIMATE SOLUTIONS OF THERMAL VISCOELASTIC STRESSES

K. C. Valanis and George Lianis Oct. 1962 31 p 3 refs
(Contract AF 94(611)-8013)
(A&ES-62-13)

The solution of viscoelastic boundary-value problems associated with thermorheologically simple viscoelastic solids in nonuniform transient temperature fields often reduces to the solution of a Volterra integral equation of the second kind. In some cases, the integral equation can be expressed in a convolution form in the reduced variable and can then be solved by taking Laplace transform. Where this, however, is impossible or where the relaxation moduli of the material are in the form of experimental curves, which is invariably the case, Volterra integral equations can be solved approximately by reduction to a set of algebraic equations. The solution of these equations is easy because the matrix of the coefficients is triangular. The error inherent in this procedure is investigated by finding first an auxiliary solution. Upper and lower bounds to this solution are then established, and these are utilized to establish an estimate to the aforementioned error. Author

N63-11316 Stanford U., Calif.

THE BUCKLING OF A FREE EDGE OF AN AXIALLY-COMPRESSED CIRCULAR CYLINDRICAL SHELL

W. Nachbar and N. J. Hoff Repr. from Quart. Appl. Math., v. 20, no. 3, Oct. 1962 p 267-277 8 refs
(NASA Grant NsG-93-60)

The knowledge regarding the discrepancies between experimental results and solution of the classical theory of the stability of thin-walled circular cylindrical shells under uniform axial compression is given as an introduction to the work described in this paper. This work consisted of a solution of the classical linear equations for free-edge boundary conditions. It is reported that the results were in much better agreement with experiment than the classic solution. In formulating the problem for the present solution, the classical equations governing the displacements of the midsurface of the shell from a state of uniform compression were used in a nondimensional form. This version of the equations was based on simplifications suggested by Donnell. The present study explains why the loaded circular edges of the shell buckle before the rest if they are not reinforced. A.S.

N63-11319 College of Aeronautics, Cranfield (Gt. Brit.)

THE EFFECT OF CURVATURE ON THE STRESS CONCENTRATIONS AROUND HOLES IN SHELLS

D. S. Houghton and A. Rothwell May 1962 21 p 9 refs Presented to the Second Intern. Conf. on Stress Analysis, Paris, Apr. 1962
(Rept. 156)

An experimental investigation has been carried out concerning the effect of curvature on the stress concentrations around holes in shell structures. Two methods have been employed: (1) Araldite cylinders, containing holes of various shapes, subjected to axial tension, internal pressure and torsion were examined by the photoelastic frozen stress technique; (2) aluminum alloy curved panels and hemispheres were used in conjunction with miniature electrical strain gauges. The results are compared with the theoretical solutions and suggest that the curvature effect can be significant, particularly for the case of shear or biaxial loading. Author

N63-11401 Forest Products Lab., Madison, Wis.
CALCULATION OF VIBRATION DAMPING IN SANDWICH CONSTRUCTION FROM DAMPING PROPERTIES OF THE CORES AND FACINGS
William L. James Dec. 1962 49 p 7 refs
(Contract AF 33(616)61-06; BuWeps Order 19-61-8041-WEPS)
(FPL-1888; *Its* ANC-23, Item 56-4)

This paper predicts natural frequency and log decrement of free vibration in strips of structural sandwich from previously measured properties of the cores and facings individually. Author

N63-11412 Forest Products Lab., Madison, Wis.
COMPRESSIVE AND SHEAR PROPERTIES OF TWO CONFIGURATIONS OF SANDWICH CORES OF CORRUGATED FOIL
G. H. Stevens Dec. 1962 15 p
(Contract AF 33(616)61-06; BuWeps Order 19-61-8041-WEPS)
(FPL-1889; *Its* ANC-23, Item 57-2)

Compressive and shear properties were determined for honeycomb and crossbanded sandwich cores of corrugated aluminum foil. Author

N63-11435 Army Missile Command. Physical Sciences Lab., Redstone Arsenal, Ala.
MECHANICAL BEHAVIOR OF STRUCTURAL MATERIALS UNDER GENERAL STRESS AND RAPID HEATING CONDITIONS (A SURVEY)
C. W. Austin June 29, 1962 56 p 101 refs
(AMC-RR-TR-62-5)

This report is a survey of literature concerning the mechanical behavior of structural materials under general stress and rapid heating conditions, with emphasis on test methods and test parameters applicable to missile structural design. The survey indicates that additional research, both applied and basic, is warranted in certain areas where there is a lack of pertinent data or a need for more fundamental information on the behavior of materials. The lack of adequate information concerning the behavior of materials subjected to general stress conditions with superimposed transient heating is particularly evident. Author

N63-11440 Giannini Controls Corp. Astromechanics Research Div., Berwyn, Pa.
PARAMETRIC ACCURACY STUDY OF A PREVIOUSLY PUBLISHED DECAY-DAMPING RELATIONSHIP [Final Report]
A. G. Fonda Dec. 1962 109 p 5 refs
(Contract AF 49(638)-1015)
(ARD-TR-02-003)

A method has been previously published, with algebraic proof, for the approximation of the "motion decay" coefficients of aeroelastic systems from their conventionally computed "required damping" coefficients. The present report compares results found by this method, for many combinations of conditions, with exact results found by otherwise less satisfactory methods. Recent refinements of the original technique are also presented. The decay-damping transformation extends the conventional "flutter solution" technique into a full predictor of classical system response. Author

N63-11443 Watertown Arsenal Labs., Mass.
THE ROTATIONALLY SYMMETRIC MOTION OF A CYLINDRICAL SHELL WITH VARIOUS END CONDITIONS DUE TO VARIOUS CONSTANT VELOCITY LOADS
Francis I. Baratta Nov. 1962 88 p 3 refs
(WAL-TR 850/13)

The general problem of thin cylinders is analyzed with various end conditions for the rotationally symmetric motions caused by the passage of a pressure front of constant velocity along the axis of the cylinder. The method of Virtual Work is applied to a generatrix of the cylinder, which is then treated as a beam on an elastic foundation with various end conditions. The results are presented in terms of three radial deflection components: (a) bending deflections, (b) rigid-body translations, and (c) rigid-body rotations. The resulting equations for the many cases considered and for particular end conditions are presented in tabular form. Author

34 STRUCTURAL DESIGN

Includes: structural elements; and weight analysis.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 33 Stresses and Loads.

N63-11050 National Aeronautics and Space Administration, Washington, D.C.
STRUCTURAL SYNTHESIS OF SYMMETRIC WAFFLE PLATE
Lucien A. Schmit and Thomas P. Kicher (Case Inst. of Tech.) Dec. 1962 62 p 7 refs
(NASA Contract NsG-110-61)
(NASA TN D-1691) OTS: $1.75

This note reports the successful development of a synthesis capability for symmetric waffle plates. The structural configuration employed as an example in this study is an integrally stiffened waffle plate used primarily for aerospace structures. The criterion of design selection employed is the total weight of the waffle. Author

N63-11056 National Aeronautics and Space Administration, Washington, D.C.
A CONTRIBUTION TO THE THEORY OF FOLDING DEFORMATIONS IN EXPANDABLE STRUCTURES WITH A PARTICULAR APPLICATION TO TOROIDAL SHELLS
H. U. Schuerch and G. M. Schindler (Astro Research Corp.) Dec. 1962 29 p 5 refs
(NASA Contract NASr-8)
(NASA TN D-1690) OTS: $0.75

Outlines for a theory of large deformations, including folding, of arbitrary inextensible membranes are presented. The approach to the problem utilizes isometric mapping techniques complemented by the additional topological constraints of the folding problem in real membrane structures. The theory is applied to an inextensible membrane in the form of a torus. Rigorous solutions are found for a particular class of deformations. Theoretical results are verified, qualitatively, by realization of predicted folding patterns on two torus models. Author

N63-11057 National Aeronautics and Space Administration, Washington, D.C.
A THEORY AND APPLICATIONS OF FILAMENTARY STRUCTURES
H. U. Schuerch, O. R. Burggraf, and A. C. Kyser (Astro Research Corp.) Dec. 1962 84 p 20 refs
(NASA Contract NASr-8)
(NASA TN D-1692) OTS: $2.25

A theory of filamentary structures consisting of monotropic membranes is presented. Applications to isotensoid pressure vessels with rotational symmetry demonstrate the use of the theory. Particular attention is given to applications of filamentary design of variable-geometry expandable structures. Experimental data, obtained from filament-wound toroidal pressure vessels, confirm the validity of the theory and demonstrate application of the analytical design technique for filamentary structures. Author

N63-11062 North American Aviation, Inc., Los Angeles, Calif.
POTENTIAL AEROTHERMOELASTIC PROBLEMS ASSOCIATED WITH ADVANCED VEHICLE DESIGN
W. R. Laidlaw and John H. Wykes *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 120-160 (See N63-11058 03-01)

Several classes of aerospace vehicles are defined according to a generalized breakdown of flight regimes and mission requirements. Within each class, typical vehicle configurations and design requirements are discussed. Particular emphasis is placed on the nature of the conflicting design requirements and the methods of resolving these conflicts as they influence or determine the solutions to critical aerothermoelastic problems. In the discussion of aerothermoelasticity, the relative influence of the problem on the final design and configuration of the vehicle is indicated. Author

N63-11107 Republic Aviation Corp., Farmingdale, N.Y.
A SURVEY OF STRUCTURAL DESIGN PROBLEMS IN A COMBINED THERMAL AND LOAD ENVIRONMENT
Robert S. Levy, Harold Switzky, Marvin Forray, Malcolm Newman, and Claus J. Meissner *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 776-846 146 refs (See N63-11058 03-01)

A survey is presented outlining the structural design problems introduced by aerodynamic heating of flight vehicle structures. Thermoelastic problems in beams, plates, and shells are reviewed. Comments are made upon structural stability and the effects of nonlinear material behavior. An attempt is made to define those problem areas which have been adequately treated analytically and/or empirically and the areas requiring additional research. The application of digital and analog computers to these problems is also discussed. Author

N63-11078 Aeronautical Systems Div. Flight Dynamics Lab., Wright-Patterson AFB, Ohio
MATERIALS AND CONSTRUCTION CONCEPTS FOR STRUCTURES SUBJECTED TO SEVERE KINETIC HEATING
Charles J. Cosenza, Jesse C. Ingram, Jr., and Robert D. Guyton (Universal Tech. Corp.) *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 847-878 (See N63-11058 03-01)

Technical advances during the past few years have established 2500° F structural concepts for application to aerospace vehicle design. Detailed structural evaluations of the refractory metal, insulative, thermostructural configurations have been conducted during the past few years; experimental test results have validated the static thermoelastic design analyses and construction techniques employed in the development of these concepts. Further efforts are being conducted to extend capabilities to 5000° F structural concepts that exhibit reliability and high integrity. Considerable research studies are being directed toward the composite and combined ablative-radiative structures to operate in this hyperthermantic environment. Programs in support of these technological areas are discussed in terms of objectives, scope, progress and problem areas. Author

N63-11079 Bell Aerosystems Co., Buffalo, N.Y.
MATRIX STRUCTURAL ANALYSIS OF HEATED AIRFRAMES
Richard H. Gallagher *In* Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio Proc. of [the first USAF] Symp. on Aerothermoelasticity, Dayton, Ohio, 30-31 Oct. and 1 Nov. 1961 Feb. 1962 p 879-917 38 refs (See N63-11058 03-01)

This paper discusses the application of matrix structural analysis methods to the solution of the deformational response problems of heated airframes. Emphasis is placed on the analysis of built-up, low-aspect-ratio lifting surfaces. Both the force and displacement approaches are considered and, for each, the analysis process leading from basic data to the various facets of structural response is provided in outline. Based on a review of recorded applications, topics in need of further development, as well as new applications, are delineated. Author

N63-11518 National Aeronautics and Space Administration, Washington, D.C.
STRUCTURES FOR SPACE OPERATIONS
Harry L. Runyan, Robert W. Leonard, Eldon E. Mathauser, Roger A. Anderson, and George W. Brooks 1962 48 p 80 refs Papers presented at Session V of the NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1-3, 1962 (See N63-11502 03-29)
(NASA-SP-28) GPO:

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